ESFR Pre-primed Single Interlock Preaction Cold Storage System

Technical Manual for Design, Installation, Operation and Maintenance

March 7, 2008

Form No. F_122807

VIKING®

TECHNICAL DATA

ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

Table of Contents	Page
I. SYSTEM DESCRIPTION	4
1. System Considerations	4
2. System Makeup	4
II. SYSTEM DESIGN	6
1. Hydraulic Calculations	6
2. Determining the Required Volume of Propylene Glycol	17
3. Typical Storage Arrangements	18
4. Designing the Detection System	26
III. INSTALLATION AND COMPONENT FUNCTIONS	27
1. Water Supply Control Valve	28
2. Grooved Couplings	28
3. Deluge Valve with Conventional Trim	29
A. Water Flow Pressure Switches (PS-10)	31
4. Electric Release Trim	32
5. Easy Riser® Check Valve with Cold Storage Trim	33
A. Cold Storage Trim with Automatic Pressure Control System	34
1. Supervisory Pressure Switch (PS-40)	34
6. Digital Pressure Switch	35
A. Description	35
B. Technical Data	35
C. Operating Modes	37
D. Installation	37
1. Electrical Connection	37
E. Inspections, Tests and Maintenance	38
7. Propylene Glycol Solution Reclaim Tank	39
8. Bypass Easy Riser® Check Valve with Bypass Trim	40
9. Downstream System Isolation Valve	41
10. CS-1 Tank & Pump Unit	42
A. Description	42
B. Technical Data	44
C. Installation	44
1. Handling	44
2. Location	44
3. Piping and Connections	44
4. Electrical Connections	45
5. Start Up	45

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

Table of Contents Continued

	Page
D. CS-1 Control Scheme	49
1. Pump Operation	49
2. System Solenoid Valve Operation	49
3. Level Switch Relay Coil Operation	49
E. Filling the Reservoir Tank	49
1. Gravity Fill	49
2. Pump Assist Fill	50
F. Filling Systems	50
G. Operating in Maintenance Mode: Automatic	52
H. Inspections, Tests and Maintenance	53
11. Air / Vacuum Vent	53
A. Installation	53
B. Ordering Information	54
C. Inspections, Tests and Maintenance	54
12. Firefighter Eliminator	56
A. Description	56
B. Technical Data	56
C. Inspections, Tests and Maintenance	56
IV. WIRING	57
1. Wiring Circuit 1	58
2. Wiring Circuit 2	59
3. Wiring Circuit 3	60
4. Wiring Circuit 4	85
V. SYSTEM OPERATION	90
Normal Condition	90
High Pressure Condition	92
Low Pressure Condition	94
Fire Condition	96
Broken Pipe Condition	98
VI. SYSTEM INSPECTIONS, TESTS AND MAINTENANCE	100
1. Solution Test Valves	102
2. Alarm Test Connection	102
3. Flow Test Valve	102
4. Service Procedures	103
APPENDIX A: ORDERING A COMPLETE SYSTEM	105
APPENDIX B: PIPING ESTIMATING TOOL	108

VIKING®

TECHNICAL DATA

ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

I. SYSTEM DESCRIPTION

The Viking ESFR Pre-Primed Single Interlock Preaction Cold Storage System is a fixed fire protection system designed for installation in refrigerated, cold storage and unheated warehouse applications with rack storage of Class II commodity on wood pallets. This system effectively prevents frost plugs associated with systems that supervise the piping network with air. The single interlock preaction system piping network is supervised with a propylene glycol solution. When using this system for single-, double- and multiple-row rack storage, Viking K25.2 ESFR sprinklers are used at the ceiling only and no in-rack sprinklers are required.

1. System Considerations

- All materials installed on the system shall be compatible with propylene glycol solution.
- Where the minimum temperature in the area being protected is 8 °F (-13.3 °C) or above, Firefighter Eliminator C 35% percent by volume propylene glycol factory premixed solution must be used.
- Where the minimum temperature in the area is between 8 °F (-13.3 °C) and -21 °F (-29.4 °C), firefighter Eliminator F 50% percent by volume propylene glycol factory premixed solution must be used.
- The minimum ambient temperature where the system can be used is -21 °F (-29.4 °C). This is not an average temperature; it is the lowest temperature within the area.
- **The system piping configuration shall be designed in a tree configuration only.** The mains and branch lines should not be looped together. **Grid systems are NOT allowed.** The piping system shall be pitched to drain completely. The branch lines shall be pitched at ¼" per 10 ft (4 mm/m) run of pipe and the mains shall be pitched ½" per 10 ft (4 mm/m) run of pipe.

2. System Makeup

Each Viking ESFR Pre-Primed Single Interlock Preaction Cold Storage System requires the following components for proper operation:

- Water Supply Control Valve
- Deluge Valve with Conventional Deluge Valve Trim
- Electric Release Trim with Solenoid Valve
- Primary Easy Riser® Check Valve with Cold Storage Trim including Automatic Pressure Control Trim
- Bypass Easy Riser® Check Valve with Bypass Trim
- Digital Supervisory Pressure Switch
- CS-1 Tank and Pump Package
- Viking VFR-400 Release Control Panel
- Reclaim tank for Automatic Pressure Control System
- System Reclaim Tank (Recommended)
- AV-1 Automatic Air Vent (One for each high point recommended)
- Firefighter Eliminator Propylene Glycol Solution
- K25.2 ESFR Pendent Sprinklers (Viking VK510)

**Please see Appendix A for Material Selection

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

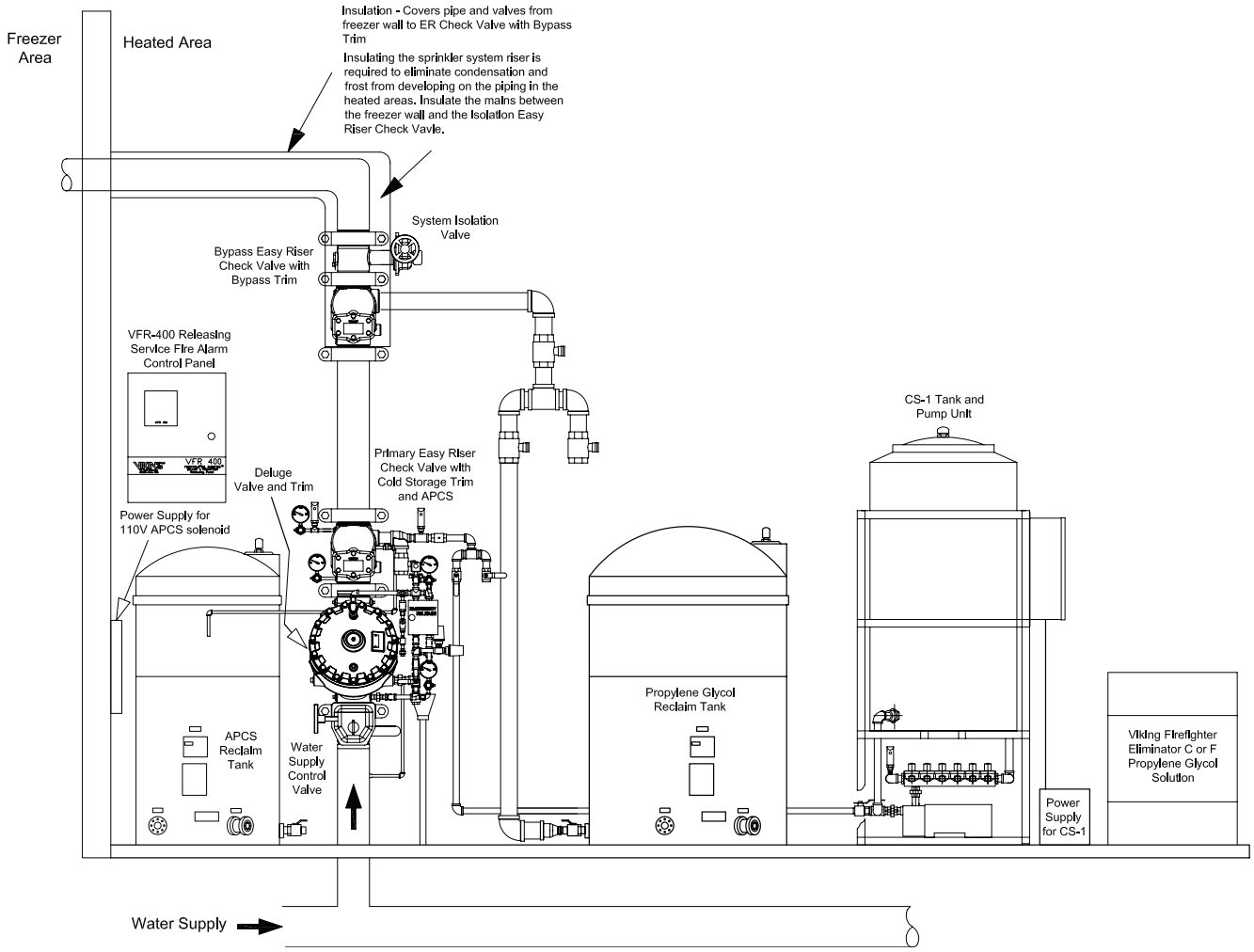

Freezer Area
Heated Area
Insulation - Covers pipe and valves from freezer wall to ER Check Valve with Bypass Trim
Insulating the sprinkler system riser is required to eliminate condensation and frost from developing on the piping in the heated areas. Insulate the mains between the freezer wall and the Isolation Easy Riser Check Vavle.
System Isolation Valve
Bypass Easy Riser Check Valve with Bypass Trim
VFR-400 Releasing Service Fire Alarm Control Panel
VFR 400
Deluge Valve and Trim
Primary Easy Riser Check Valve with Cold Storage Trim and APCS
Power Supply for 110V APCS solenoid
CS-1 Tank and Pump Unit
Propylene Glycol Reclaim Tank
APCS Reclaim Tank
Water Supply Control Valve
Viking Firefighter Eliminator C or F Propylene Glycol Solution
Power Supply for CS-1
Water Supply

Figure 1 - Viking ESFR Pre-Primed Single Interlock Preaction Cold Storage System

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

This system shall be designed by qualified fire protection professionals in conjunction with the requirements listed in this technical data, NFPA 13, and those of the authority having jurisdiction. The system designer must read and apply all of the following design requirements.

II. SYSTEM DESIGN

1. Hydraulic Calculations

Two hydraulic calculations are required for the system:

The first calculation shall be with the 12 Viking VK510 K25.2 ESFR's assuming they are flowing water. This calculation shall include 4 sprinklers on the 3 most hydraulically remote branch lines discharging at the minimum design pressure for the system. This calculation shall use the Hazen Williams formula. See examples in Figures 3 & 4.

The second calculation shall include 6 Viking VK510 K25.2 ESFR's flowing propylene glycol solution. The calculation shall include 4 sprinklers on the most hydraulically remote branch line and 2 sprinklers on the second most hydraulically remote branch line discharging at the minimum design pressure required for the system. This calculation shall use the Darcy-Weisbach formula. See examples in Figures 6-8.

Full-scale fire testing has demonstrated that the propylene glycol solution will be expelled from the system by the time 6 sprinklers are operating in a fire condition. The 6-head sprinkler calculation using the Darcy-Weisbach formula is used to ensure that the piping has been sized properly and the water supply is adequate for the more viscous liquid. Because the propylene glycol will have a dramatically different viscosity at the colder temperature expected in this application, friction loss through the piping network will be significantly higher than water.

When conducting hydraulic calculations, a good rule of thumb is to increase pipe size when friction loss has reached .3 PSI per foot of pipe. By setting up the spreadsheet described in Appendix B, a quick estimation of the difference in friction loss will assist in determining if the desired pipe size will be adequate. The final pipe sizes will need to be confirmed through the actual hydraulic calculations.

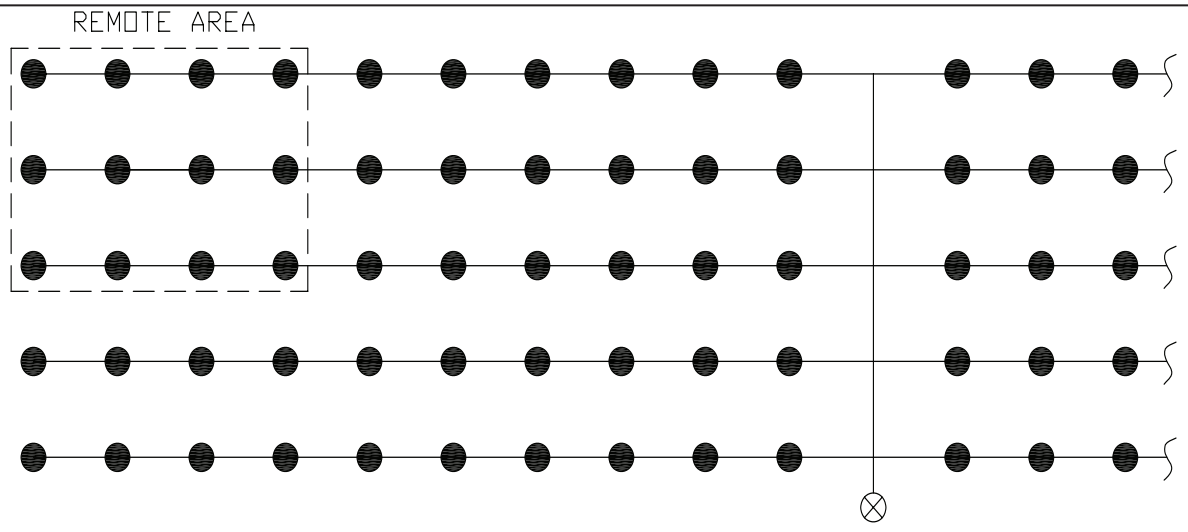


Figure 2 - Example of Remote Area for Hazen Williams Calculation Center Feed Tree

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

CONTRACT NAME_ABC Freezer -20 Degrees Class II Commodity_____ SHEET__1___OF__2___

STEP NO.	NOZZLE IDENT. AND LOCATION	FLOW IN G.P.M.	PIPE SIZE	PIPE FITTINGS AND DEVICES	EQUIV. PIPE LENGTH	FRICTION LOSS P.S.I./ FOOT	PRESSURE SUMMARY	NORMAL PRESSURE	NOTES	REF. STEP
1	Spkr #1	q Q 195.2	Sch 10 3" 3.26		L 10-0 F T 10-0	C120 0.03	Pt 60 Pe Pf .3	Pt Pv Pn	Viking K 25.2 Hazen Williams 60 psi Required Q=K√P 25.2√60 Q=195.2	
2	Spkr #2	q 195.6 Q 390.8	3" 3.26		L 10-0 F T 10-0	0.12	Pt 60.3 Pe Pf 1.2	Pt Pv Pn	Q=25.2√60.3 Q=195.6	
3	Spkr # 3	q 197.6 Q 588.4	3" 3.26		L 10-0 F T 10-0	0.27	Pt 61.5 Pe Pf 2.7	Pt Pv Pn	Q=25.2√61.5 Q=197.6	
4	Spkr # 4	q 201.9 Q 790.3	3" 3.29	1- Tee	L 31-3 F 20 T 51-3	0.48	Pt 64.2 Pe Pf 24.6	Pt Pv Pn	Q=25.2√64.2 Q=201.9 Fitting Adj for Diameter 15 x 1.34 = 20	
5	To Bottom of Riser Nipple	q Q 790.3	3" 3.26	1- Tee	L 2-0 F 20 T 22	0.46	Pt 88 Pe Pf 10.2	Pt Pv Pn	Fitting Adj for Diameter 15 x 1.34 = 20	
		q Q			L F T		Pt 98.2 Pe Pf	Pt Pv Pn	K=Q/√P K=790.3/√98.2 K=80.12	
6	RN-1	q Q 790.3	Sch 10 6" 6.357		L 10-0 F T 10-0	0.01	Pt 98.2 Pe Pf .1	Pt Pv Pn		
7	RN-2	q 794.3 Q 1584.6	6" 6.357		L 10-0 F T 10-0	0.06	Pt 98.3 Pe Pf .6	Pt Pv Pn	Q=K√P Q=80.12√98.3 Q=794.3	
8	RN-3	q 796.7 Q 2381.3	6" 6.357		L F T		Pt 98.9 Pe Pf	Pt Pv Pn	Q=K√P Q=80.12√98.9 Q=796.7	
9	To Top of Riser	q Q 2381.3	6" 6.357	1-LTR EL 1-Tee	L 154 F 47 T 201	0.13	Pt 98.9 Pe Pf 27.8	Pt Pv Pn	Fittings Adj for Diameter	
10	To Bottom of Riser	q Q 2381.3	6" 6.357	2- CHK Vl 1- Deluge 1- Btr Fly	L 37 F 91 T 128	0.13	Pt 126.7 Pe 19 Pf 17.7 Pt 163.4	Pt Pv Pn	Elevation 43.75 .433 x 43.75 Fittings Adj for Diameter	

VIKING
The Viking Corporation
Hastings, Michigan
Litho in U.S.A. Form 3017-HB

Figure 3 - Hazen Williams Example Calculation of the 25,000 ft.² Tree System Shown in Figure 9, Sheet 1

VIKING® **TECHNICAL DATA** **ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM**

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

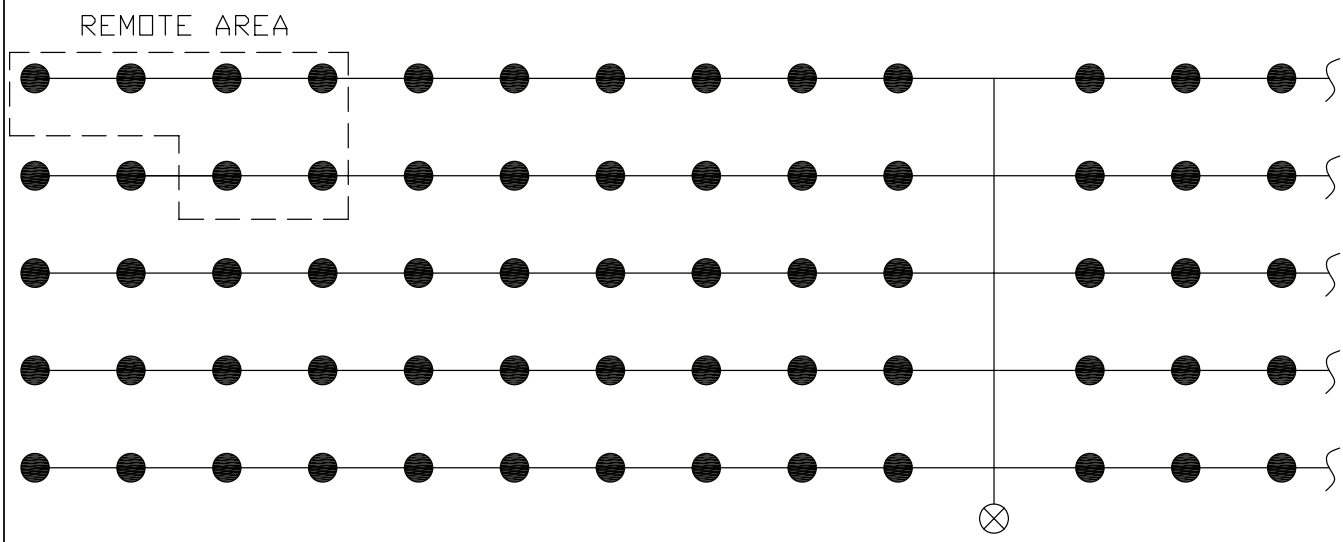
CONTRACT NAME__ABC Freezer -20 Degrees Class II Commodity _____ SHEET__2___OF__2___

STEP NO.	NOZZLE IDENT. AND LOCATION	FLOW IN G.P.M.	PIPE SIZE	PIPE FITTINGS AND DEVICES	EQUIV. PIPE LENGTH	FRICTION LOSS P.S.I./ FOOT	PRESSURE SUMMARY	NORMAL PRESSURE	NOTES	REF. STEP
11	Hose Stream	q 250			L		Pt	Pt		
					F		Pe	Pv		
		Q 2631.3			T		Pf	Pn		
12	To Street	q	CL-52	1-EL	L 100	C 140	Pt 163.4	Pt	48 x 1.33 x 1.05 fittings adj for C factor and diameter	
			8"	1 Gt vlv	F 67		Pe	Pv		
		Q 2631.3	8.385	1- Tee	T 167	0.02	Pf 4.5	Pn		
		q			L		Pt 168	Pt		
					F		Pe	Pv		
		Q			T		Pf	Pn		
		q			L		Pt	Pt	System Demand 2631 gpm @ 168 psi	
					F		Pe	Pv		
		Q			T		Pf	Pn		
		q			L		Pt	Pt		
					F		Pe	Pv		
		Q			T		Pf	Pn		
		q			L		Pt	Pt		
					F		Pe	Pv		
		Q			T		Pf	Pn		
		q			L		Pt	Pt		
					F		Pe	Pv		
		Q			T		Pf	Pn		
		q			L		Pt	Pt		
					F		Pe	Pv		
		Q			T		Pf	Pn		
		q			L		Pt	Pt		
					F		Pe	Pv		
		Q			T		Pf	Pn		
		q			L		Pt	Pt		
					F		Pe	Pv		
		Q			T		Pf	Pn		
							Pt			

The Viking Corporation
Hastings, Michigan
Litho in U.S.A. Form 3017-HB

Figure 4 - Hazen Williams Example Calculation of the 25,000 ft.^{2} tree system shown in Figure 9, Sheet 2

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



Typically, when a partial branch line is required in the hydraulic calculations, the sprinklers closer to the cross main will be used, as shown above. The calculation of the closer sprinklers will result in less friction loss and a smaller pressure demand on the branch line. At the cross main, a K factor for the branch lines will need to be determined. The lower pressure requirement will result in a larger K factor and thus require more water on the partial branch line, typically making the closer sprinklers more demanding.

Figure 5 - Example of Remote Area for Darcy-Weisbach Calculation Center Feed Tree

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

Darcy-Weisbach Method for Calculating Friction in Piping:

Most hydraulic calculation software used in the sprinkler industry today has the option for conducting the piping friction loss calculations with the Darcy-Weisbach method. The reason for conducting the additional 6 sprinkler head calculation is to verify that the available water supply pressure is adequate for the initial discharge of propylene glycol solution. The example calculations provided in Figures 6-8 illustrate the difference in results that can occur when calculating for the more viscous propylene glycol solution versus the standard Hazen-Williams calculation for water illustrated in Figures 3-4. For those not familiar with the Darcy-Weisbach method below is the basic procedure that is used to conduct the calculation. This is intended only to provide the designer with an understanding of the concepts of the method. It is not practical that the calculation be done by hand as this would be much too time consuming and subject to potential errors.

The Darcy-Weisbach Formula as found in most text is written as: $h= (f)\ (l)\ (v)^2 / (d)\ (2)\ (g)$

h=friction loss (ft of head)

f=friction factor (from Moody Diagram-Figure 10)

l=length of pipe (ft)

v=velocity (ft/sec)

d=diameter of pipe (ft)

g=gravitational constant (32.2 ft/sec^2)

This formula can be rearranged and simplified to:

When the calculated Reynolds Number (Re) is >2000 $=0.000216\ fL\rho Q^2/d^5$ =Friction Loss (psi)

When the calculated Reynolds Number (Re) is <2000 $=0.000273\ \mu LQ/d^4$ =Friction Loss (psi)

Where:

$Re=50.6Q\rho/d\mu$

Q=flow (gpm)

ρ=density (lbs/ft^3)

d=internal pipe diameter (in)

D=internal pipe diameter (ft)

L=pipe length (ft)

μ=dynamic viscosity (cps)

ε= .00033 for steel pipe

f=friction factor, If Re > 2000, use Moody Diagram (Figure 10). If Re < 2000, f = 64/Re.

Procedure:

1. Calculate Reynolds Number (Re) = $50.6Q\rho/d\mu$
2. Calculate relative roughness of pipe = ε/D

ε= .00033 (ft)

D=internal pipe diameter (ft)

3. Use Moody Diagram (Figure 10) to find “f” if Re > 2000. If Re < 2000, f = 64/Re.
4. Use fiction loss in hydraulic calculation.

VIKING® **TECHNICAL DATA** **ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM**

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

CONTRACT NAME_ABC Freezer -20 Degrees Class II Commodity_____ SHEET__1___OF__3___

STEP NO.	NOZZLE IDENT. AND LOCATION	FLOW IN G.P.M.	PIPE SIZE	PIPE FITTINGS AND DEVICES	EQUIV. PIPE LENGTH	FRICTION LOSS P.S.I./ FOOT	PRESSURE SUMMARY	NORMAL PRESSURE	NOTES	REF. STEP
1	Spkr #1	q Q 195.2	Sch 10 3" 3.26		L 10-0 F T 10-0	0.08	Pt 60 Pe Pf .8	Pt Pv Pn	Viking K 25.2 Darcy Weisbach 60 psi Required Q=K√P 25.2√60 Q=195.2	
2	Spkr #2	q 196.4 Q 391.6	3" 3.26		L 10-0 F T 10-0	0.3	Pt 60.8 Pe Pf 3.0	Pt Pv Pn	Q=25.2√60.8 Q=196.4	
3	Spkr #3	q 201.2 Q 592.8	3" 3.26		L 10-0 F T 10-0	0.61	Pt 63.8 Pe Pf 6.1	Pt Pv Pn	Q= 25.2√63.8 Q=201.2	
4	Spkr #4	q 210.6 Q 803.4	3" 3.26	1-Tee	L 31-3 F 20 T 51-3	1.03	Pt 69.9 Pe Pf 52	Pt Pv Pn	Q=25.2√69.9 Q=210.6 Fitting Adj for Diameter 15 x 1.34 = 20	
5	To Bottom of Riser Nipple	q Q 803.4	3" 3.26	1-Tee	L 2-0 F 20 T 22-0	1.03	Pt 121 Pe Pf 22.6	Pt Pv Pn	Fitting Adj for Diameter 15 x 1.34 = 20	
		q Q			L F T		Pt 143.6 Pe Pf	Pt Pv Pn	K=Q/√P K=803.4/√143.6 K=67	
6	RN-1	q Q 803.4	Sch 10 6" 6.357		L 10-0 F T 10-0	0.04	Pt 143.6 Pe Pf .4	Pt Pv Pn		
7	RN-2	q 540 Q 1343.4	6" 6.357		L F T		Pt 144 Pe Pf	Pt Pv Pn	Q=K√P Q=45√144 Q=540 K 45 from Sheet 3 of 3	
8	To Top of Riser	q Q 1343.4	6" 6.357	1- LTR EL 1- Tee	L 154-0 F 47-0 T 201-0	0.1	Pt 144 Pe Pf 21	Pt Pv Pn	Fitting Adj for Diameter	
9	To Bottom of Riser	q Q 1343.4		2- Chk Vl 1- Deluge 1- Btr Fly	L 37 F 91 T 128	0.1	Pt 165 Pe 19 Pf 12.8	Pt Pv Pn	Elevation 43.75 .433 x 43.75 19 psi Fitting Adj for Diameter	
10	Hose Stream	q 250 Q 1593.4			L F T		Pt 196.8 Pe Pf	Pt Pv Pn		
							Pt 196.8			

VIKING

The Viking Corporation
Hastings, Michigan
Litho in U.S.A. Form 3017-HB

Figure 6 - Darcy-Weisbach Example Calculation of the 25,000 ft.^{2} Tree System Shown in Figure 9, Sheet 1

VIKING® **TECHNICAL DATA** **ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM**

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

CONTRACT NAME_ABC Freezer -20 Degrees Class II Commodity_____ SHEET__2___OF__3___

STEP NO.	NOZZLE IDENT. AND LOCATION	FLOW IN G.P.M.	PIPE SIZE	PIPE FITTINGS AND DEVICES	EQUIV. PIPE LENGTH	FRICTION LOSS P.S.I./ FOOT	PRESSURE SUMMARY	NORMAL PRESSURE	NOTES	REF. STEP
11	To Street	q 1593.4	CL-52 8" 8.385	1-El 1- GT Vl 1-Tee	L 100 F 67 T 167	C 140 0.03	Pt 196.8 Pe Pf 6.4	Pt Pv Pn	48 x 1.33 x 1.05 Fittings Adj Adj for C Factor and Diameter	
		q Q			L F T		Pt 203.2 Pe Pf	Pt Pv Pn		
		q Q			L F T		Pt Pe Pf	Pt Pv Pn	System Demand 1593 gpm @ 203 psi	
		q Q			L F T		Pt Pe Pf	Pt Pv Pn		
		q Q			L F T		Pt Pe Pf	Pt Pv Pn		
		q Q			L F T		Pt Pe Pf	Pt Pv Pn		
		q Q			L F T		Pt Pe Pf	Pt Pv Pn		
		q Q			L F T		Pt Pe Pf	Pt Pv Pn		
		q Q			L F T		Pt Pe Pf	Pt Pv Pn		
		q Q			L F T		Pt Pe Pf	Pt Pv Pn		
		q Q			L F T		Pt Pe Pf	Pt Pv Pn		
							Pt			

VIKING

The Viking Corporation
Hastings, Michigan
Litho in U.S.A. Form 3017-HB

Figure 7 - Darcy-Weisbach Example Calculation of the 25,000 ft.^{2} Tree System Shown in Figure 9, Sheet 2

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

CONTRACT NAME__ABC Freezer -20 Degrees Class II Commodity_____ SHEET__3___OF__3___

STEP NO.	NOZZLE IDENT. AND LOCATION	FLOW IN G.P.M.	PIPE SIZE	PIPE FITTINGS AND DEVICES	EQUIV. PIPE LENGTH	FRICTION LOSS P.S.I./ FOOT	PRESSURE SUMMARY	NORMAL PRESSURE	NOTES	REF. STEP
12	Spkr #5	q	Sch 10		L 10-0		Pt 60	Pt	Q=K√P Q=25.2√60 Q=195.2	
			3"		F		Pe	Pv		
		Q 195.2	3.26		T 10-0	0.08	Pf .8	Pn		
13	Spkr#6	q 196.4			L 28-9		Pt 60.8	Pt	Q=K√P Q=25.2√60.8 Q=195.2 Fitting Adj for Diameter	
			3"	1-Tee	F 20-0		Pe	Pv		
		Q 391.6	3.26		T 48-9	0.3	Pf 14.9	Pn		
		q			L		Pt 75.7	Pt	K=Q/√P K=391.6/√75.7 K=45	
					F		Pe	Pv		
		Q			T		Pf	Pn		
		q			L		Pt	Pt		
					F		Pe	Pv		
		Q			T		Pf	Pn		
		q			L		Pt	Pt		
					F		Pe	Pv		
		Q			T		Pf	Pn		
		q			L		Pt	Pt		
					F		Pe	Pv		
		Q			T		Pf	Pn		
		q			L		Pt	Pt		
					F		Pe	Pv		
		Q			T		Pf	Pn		
		q			L		Pt	Pt		
					F		Pe	Pv		
		Q			T		Pf	Pn		
		q			L		Pt	Pt		
					F		Pe	Pv		
		Q			T		Pf	Pn		
		q			L		Pt	Pt		
					F		Pe	Pv		
		Q			T		Pf	Pn		
							Pt			

The Viking Corporation
Hastings, Michigan
Litho in U.S.A. Form 3017-HB

Figure 8 - Darcy-Weisbach Example Calculation of the 25,000 ft.² Tree System Shown in Figure 9, Sheet 3

VIKING®

TECHNICAL DATA

ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

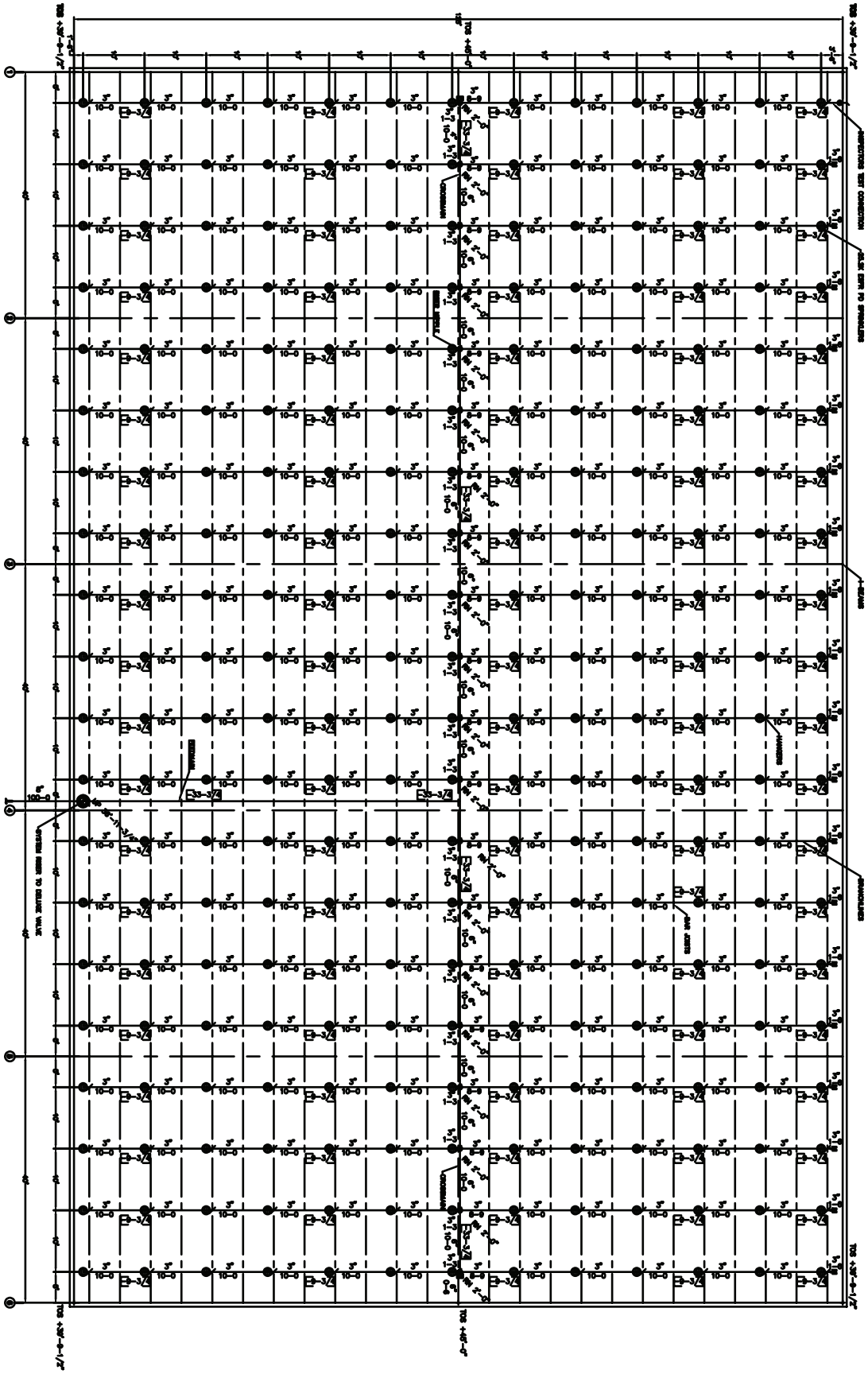


Figure 9 - Plan View of 25,000 Square Foot System

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

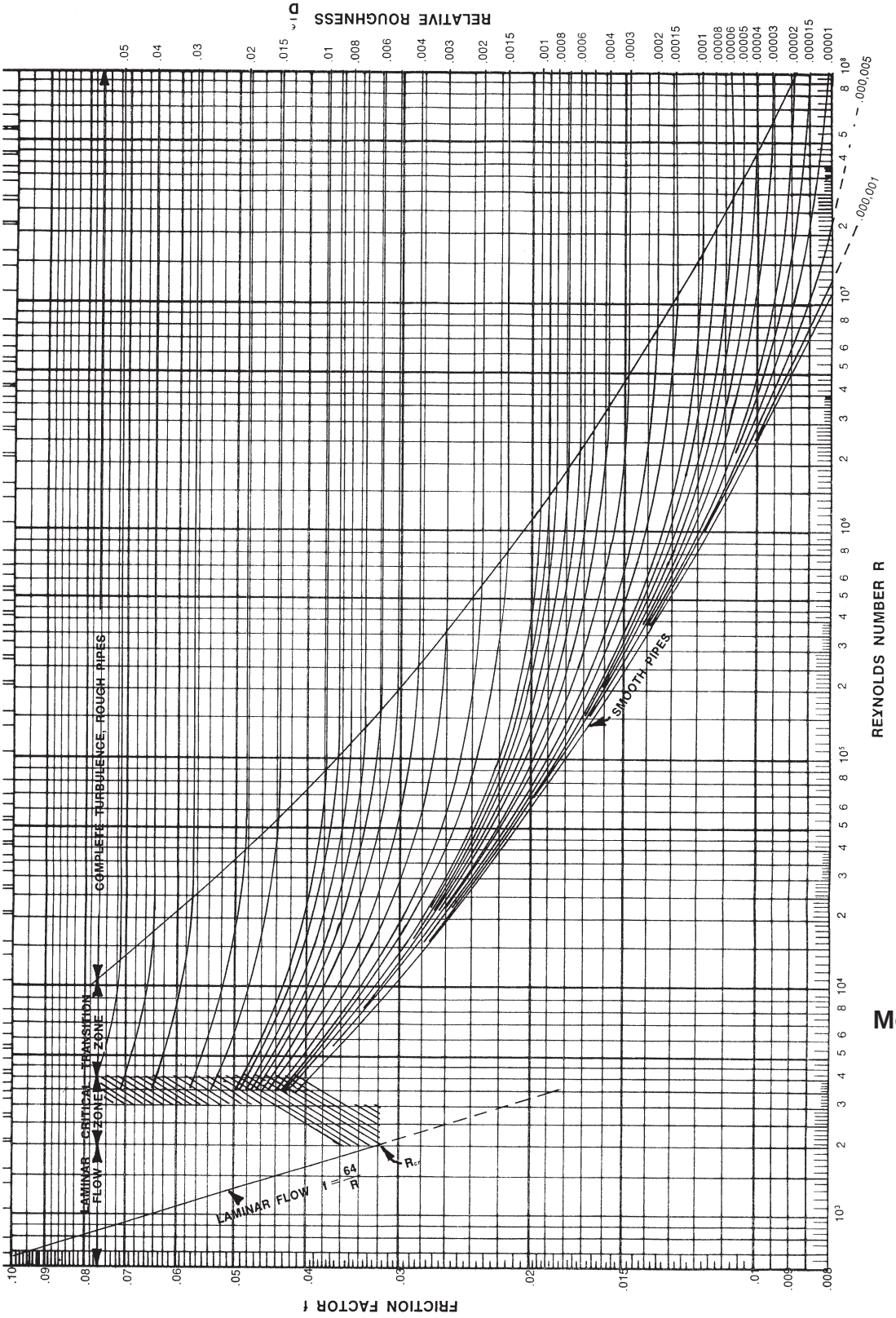


Figure 10 - Moody Diagram

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

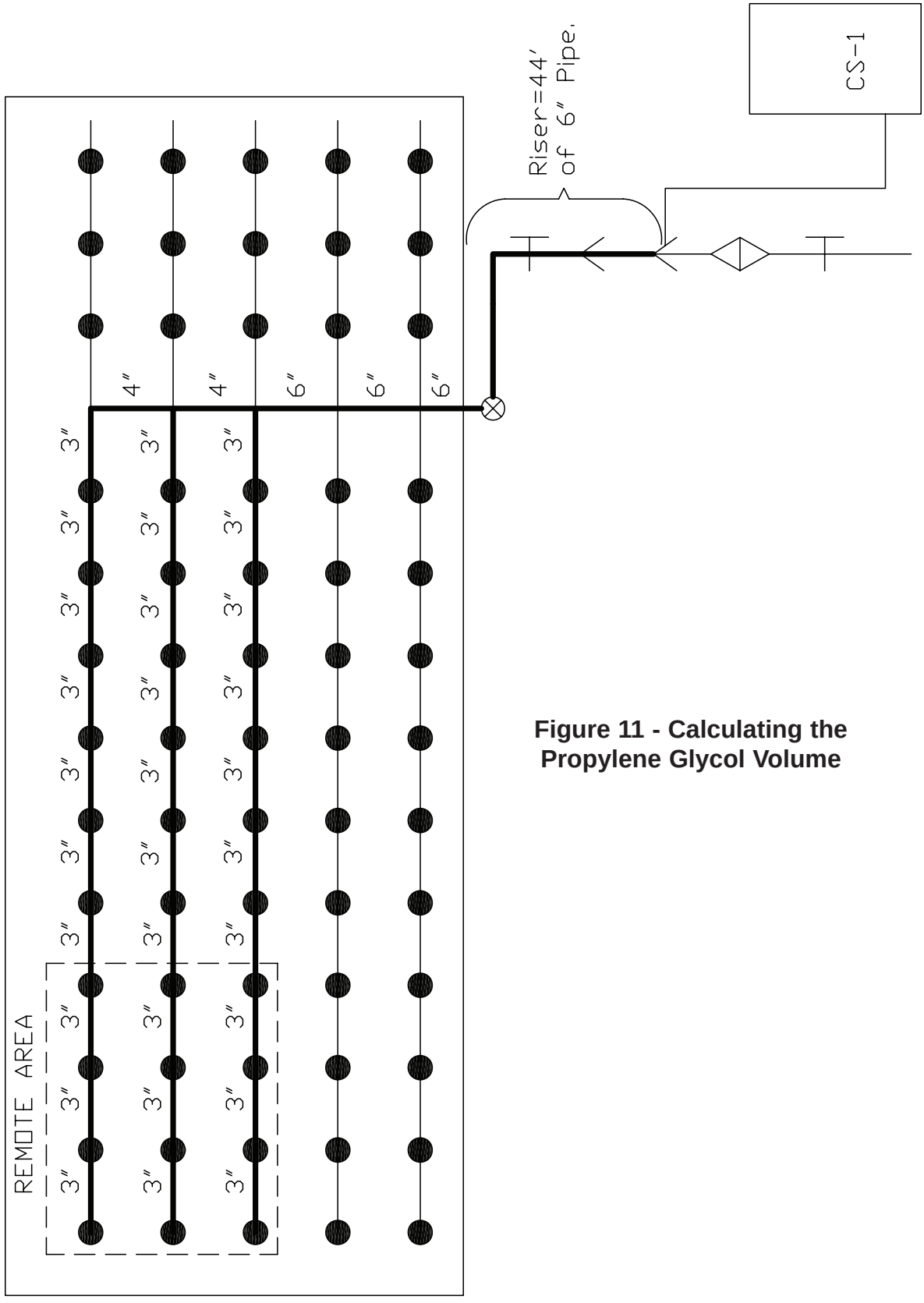


Figure 11 - Calculating the Propylene Glycol Volume

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

2. Determining the Required Volume of Propylene Glycol

The system design area (12 sprinklers: 4 on each of the 3 hydraulically most remote branch lines) and bulk main to the primary Easy Riser® Check Valve (lines in bold) at the base of the riser is limited to a total volume of 1,100 gallons.* Additional mains and sprinkler lines attached to the sprinkler system, but not in the direct path to the base of the riser, do not need to be considered in the volume restriction.

The actual volume of propylene glycol solution for the sprinkler system is determined by adding all the sprinkler piping together. Additional propylene glycol is added to this total for the CS-1 Tank and supply lines to the riser.

Table 1

From NFPA 13 - Table A.7.2.3 - Capacity of 1 ft. of Pipe (Based on Actual Internal Pipe Diameter)

Nominal Pipe Diameter		Pipe		Nominal Pipe Diameter		Pipe	
in.	mm	Schedule 40 (gal)	Schedule 10 (gal)	in.	mm	Schedule 40 (gal)	Schedule 10 (gal)
3/4	20	0.028	-	3	80	0.383	0.433
1	25	0.045	0.049	3½	90	0.513	0.576
1¼	32	0.078	0.085	4	100	0.660	0.740
1½	40	0.106	0.115	5	125	1.040	1.144
2	50	0.174	0.190	6	150	1.501	1.649[b]
2½	65	0.248	0.283	8	200	2.66[a]	2.776[c]

For SI units, 1 in. = 25.4 mm; 1 ft. = 0.3048 m; 1 gal = 3.785 L.

[a] Schedule 80.

[b] 0.134 wall pipe.

[c] 0.188 wall pipe.

Example:

- Assume 100 ft² spacing, 10 ft between the sprinklers and 10 ft between the branch lines.
- Schedule 10 Pipe.

3” Pipe = 300’ x .433 = 129.9 gal.
4” Pipe = 20’ x .740 = 14.8 gal.
6” Pipe = 74’ x 1.649 = 120.0 gal.
Total Volume = 247 gal.

* Note: Based on the installation history of this system, systems near 25,000 ft² in area, with long runs on feed main, typically begin to approach the 1,100 gallon restriction, or begin to demand excessive pressures in the Darcy-Weisbach calculation. This history can be used as an estimating tool, however, the actual system volume must be calculated.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

3. Typical Storage Arrangements

Definitions:

Class II Commodity - A Class II commodity shall be defined as a noncombustible product that is in slatted wooden crates, solid wood boxes, multiple layered corrugated cartons or equivalent combustible packaging material with or without pallets.

Longitudinal Flue Space - The space between the rows of storage perpendicular to the direction of loading.

Transverse Flue Space - The distance between rows of storage parallel to the direction of loading.

L = Longitudinal Flue Space
T = Transverse Flue Space

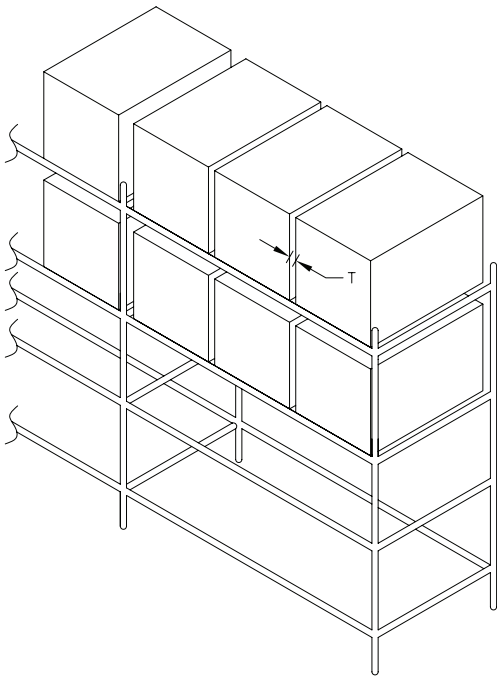


Figure 12 - Single Row Rack Storage

Racks that have no longitudinal flue space and that have width up to 6 ft, and aisles at leas 3½ ft from any other storage.

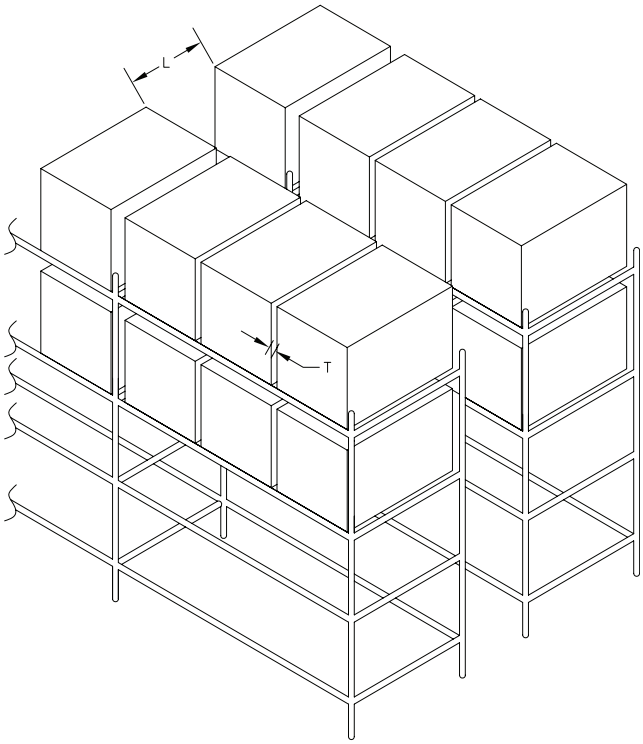
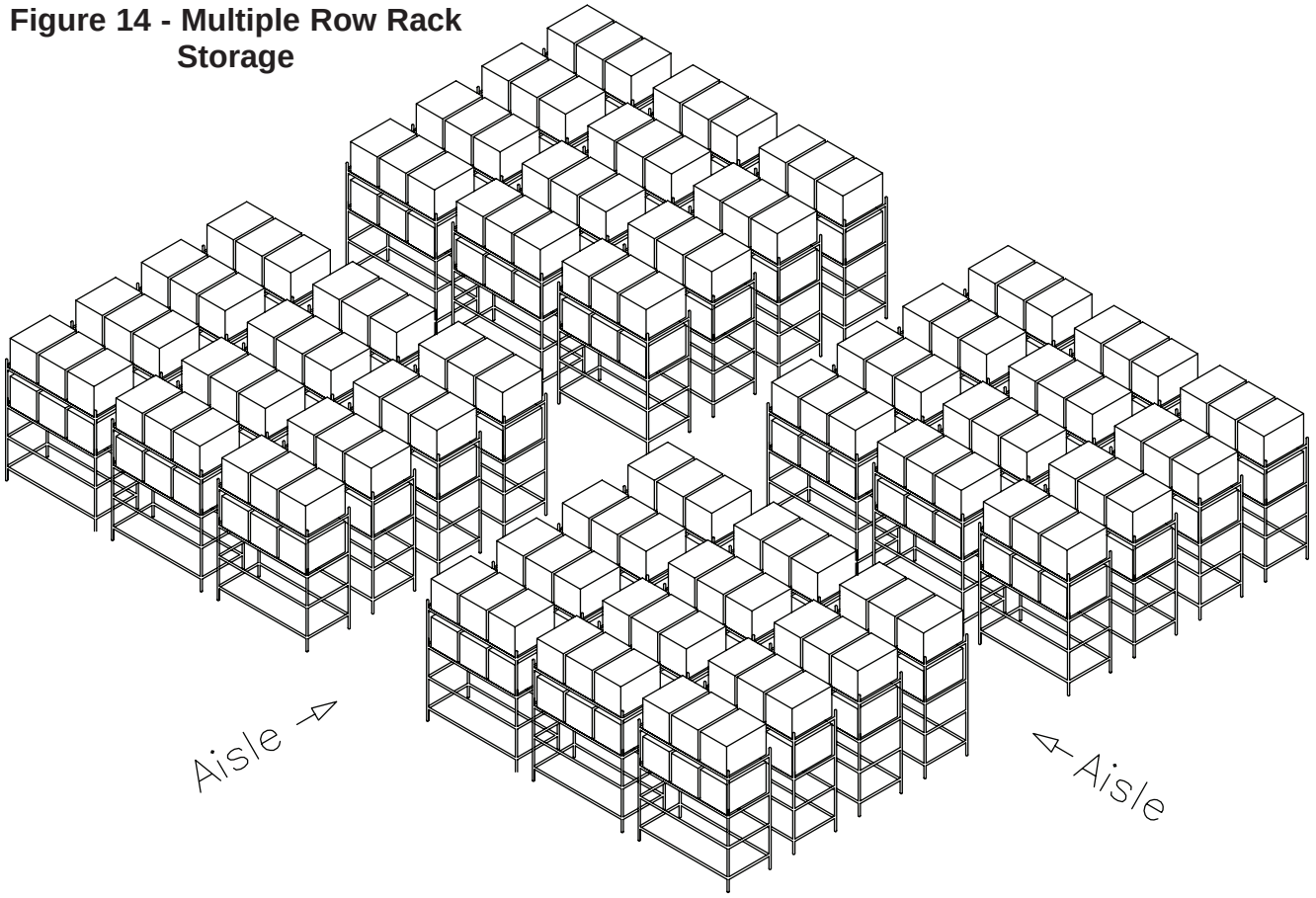


Figure 13 - Double Row Rack Storage

Two single row racks placed back to back having a combined width up to 12 ft with aisles at least 3½ ft on each side.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

Figure 14 - Multiple Row Rack Storage



Racks greater than 12 ft (3.7 m) wide or single or double row racks separated by aisles less than 3½ ft (1.07 mm) wide having an overall width greater than 12 ft (3.7 m).

Notes:

1. **The system is acceptable for use with Class I and Class II commodities only.**
2. For use with a maximum 50% by volume propylene glycol and water antifreeze solution with a maximum ceiling height of 40 ft (12.2 m) and a maximum Class II commodity height of 35 ft (10.7 m) with a maximum deflector distance below the ceiling of 18” (457 mm). The minimum starting pressure is 40 PSI (2.76 Bar).
3. For use with a maximum 50% by volume propylene glycol and water antifreeze solution with a maximum ceiling height of 45ft-3 in (13.8 m) and a maximum Class II commodity height of 40 ft (12.2 m) with a maximum deflector distance below the ceiling of 14” (356 mm). The minimum starting pressure is 60 PSI (4.14 Bar).
4. The VK510 ESFR’s shall be ordinary temperature 165 °F (74 °C) except where required to be intermediate temperature 205 °F (96 °C) due to close proximity to heating sources as described in NFPA 13.
5. The system shall be designed so that the maximum operating pressure does not exceed 175 PSI (12 Bar) at the ESFR sprinklers.
6. Only wood pallets are acceptable.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

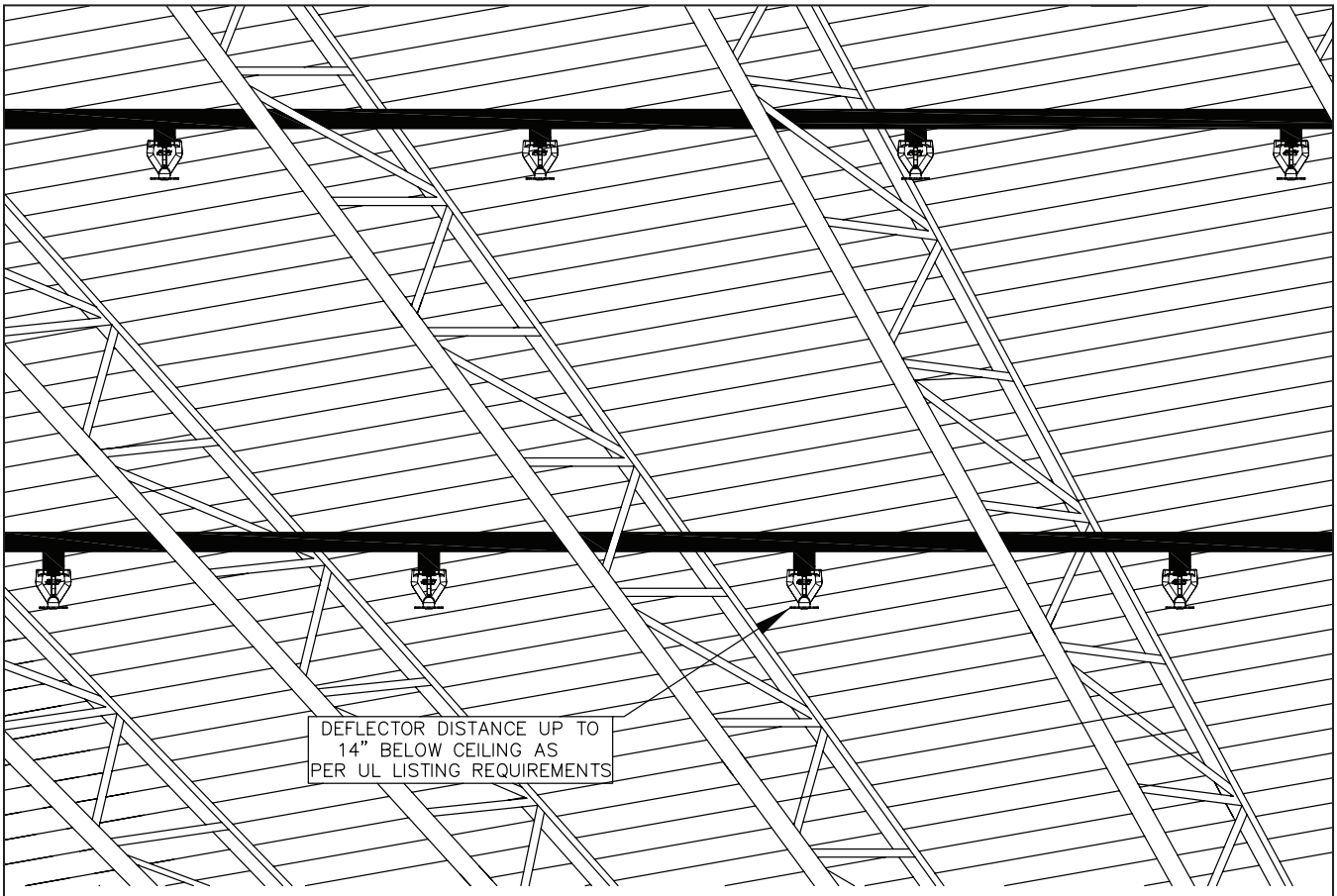


Figure 15 - Maximum ceiling height of 45 ft-3 in and a maximum height of 40 ft with a maximum deflector distance below the ceiling of 14"

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

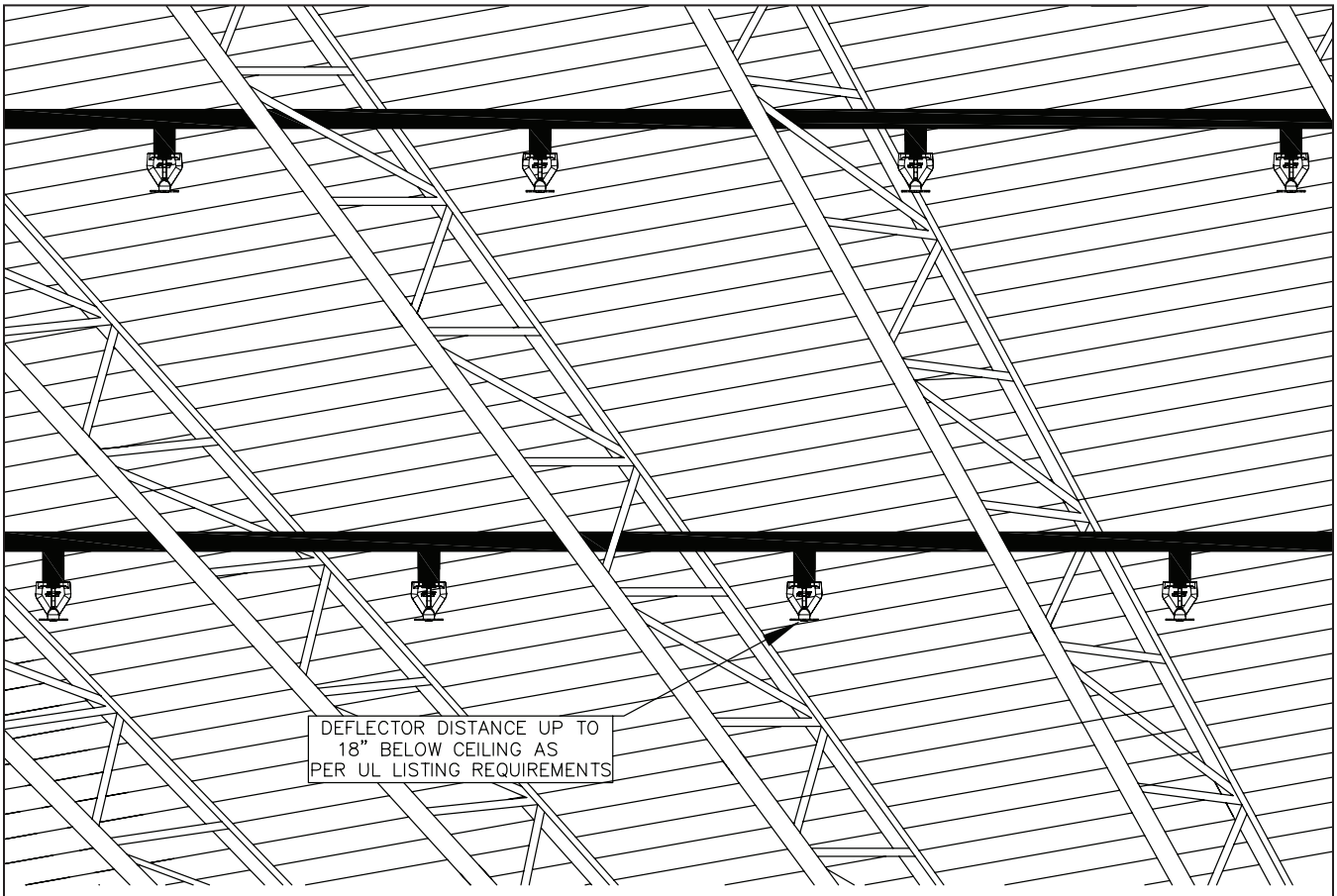


Figure 16 - Maximum ceiling height of 40 ft and commodity height of 35 ft with a maximum deflector distance below the ceiling of 18"

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

Table 2 - NFPA 13 Table A5.6.3.1, 2007 Edition

Table A.5.6.3.1 Examples of Class I Commodities

Alcoholic Beverages
Cartoned or uncartoned
- Up to 20 percent alcohol in metal, glass, or ceramic containers

Appliances, Major (e.g., stoves, refrigerators)
- Not packaged, no appreciable plastic exterior trim

Batteries
Dry cells (nonlithium or similar exotic metals)
- Packaged in cartons

Automobile
- Filled*

Bottles, Jars
Empty, cartoned
- Glass

Filled noncombustible liquids
- Glass, cartoned
- Plastic, cartoned [less than 5 gal (18.9 L)]
- Plastic, PET

Filled noncombustible powders
- Glass, cartoned

Canned Foods
In ordinary cartons

Cans
Metal
- Empty

Cement
Bagged

Coffee
Canned, cartoned

Fertilizers
Bagged
- Phosphates

File Cabinets
Metal
- Cardboard box or shroud

Fish or Fish Products
Frozen
- Nonwaxed, nonplastic packaging

Canned
- Cartoned

Frozen Foods
Nonwaxed, nonplastic packaging

Fruit
Fresh
- Nonplastic trays or containers
-With wood spacers

Ice Cream

Table A.5.6.3.1 *Continued*

Meat, Meat Products
- Bulk
- Canned, cartoned
- Frozen, nonwaxed, nonplastic containers

Metal Desks
-With plastic tops and trim

Milk
- Nonwaxed-paper containers
- Waxed-paper containers
- Plastic containers

Motors
- Electric

Nuts
- Canned, cartoned

Paints
Friction-top cans, cartoned
- Water-based (latex)

Plastic Containers
- Noncombustible liquids or semiliquids in plastic containers less than 5 gal (18.9 L) capacity

Poultry Products
- Canned, cartoned
- Frozen, nonwaxed, nonplastic containers

Salt
Bagged

Syrup
Drummed (metal containers)

Transformers
Dry and oil filled

Wire
Bare wire on metal spools on wood skids

*Most batteries have a polypropylene case and, if stored empty, should be treated as a Group A plastic. Truck batteries, even where filled, should be considered a Group A plastic because of their thicker walls.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

Table 3 - NFPA 13 Table A.5.6.3.2, 2007 Edition

Table A.5.6.3.2 Examples of Class II Commodities

Alcoholic Beverages
Up to 20 percent alcohol in wood containers
Appliances, Major (e.g., stoves)
Corrugated, cartoned (no appreciable plastic trim)
Baked Goods
Cookies, cakes, pies
- Frozen, packaged in cartons*
Batteries
Dry cells (nonlithium or similar exotic metals) in blister pack in cartons
Bottles, Jars
Filled noncombustible powders
- Plastic PET
Boxes, Crates
Empty, wood, solid walls
Fertilizers
Bagged
- Nitrates
Fish or Fish Products
Frozen
- Waxed-paper containers, cartoned
- Boxed or barreled
Frozen Foods
Waxed-paper containers, cartoned
Leather Hides
Baled
Light Fixtures
Nonplastic
- Cartoned
Marble
Artificial sinks, countertops
- Cartoned, crated
Meat, Meat Products
- Frozen, waxed-paper containers
- Frozen, expanded plastic trays
Pharmaceuticals
Pills, powders
- Glass bottles, cartoned
Nonflammable liquids
- Glass bottles, cartoned
Photographic Film
- Motion picture or bulk rolls of film in polycarbonate, polyethylene, or metal cans; polyethylene bagged in cardboard boxes

Table A.5.6.3.2 *Continued*

Plastic Containers
Noncombustible liquids or semiliquids (such as ketchup) in plastic containers with nominal wall thickness of L/4 in. (6.4 mm) or less and larger than 5 gal (18.9 L) capacity
Poultry Products
Frozen (on paper or expanded plastic trays)
Powders (ordinary combustibles - free flowing)
In paper bags (e.g., flour, sugar)
Salt
Packaged, cartoned
Shock Absorbers
Metal dust cover
Signatures
Book, magazines
- Solid array on pallet
Syrup
Barreled, wood
Wire
- Bare wire on wood or cardboard spools on wood skids
- Bare wire on metal, wood, or cardboard spools in cardboard boxes on wood skids
- Single- or multiple-layer PVC-covered wire on metal spools on wood skids
- Insulated (PVC) cable on large wood or metal spools on wood skids
Wood Products
Solid piles
- Lumber, plywood, particle board, pressboard (smooth ends and edges)

*The product is in a plastic-coated package in a corrugated carton. If packaged in a metal foil, it can be considered Class I.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

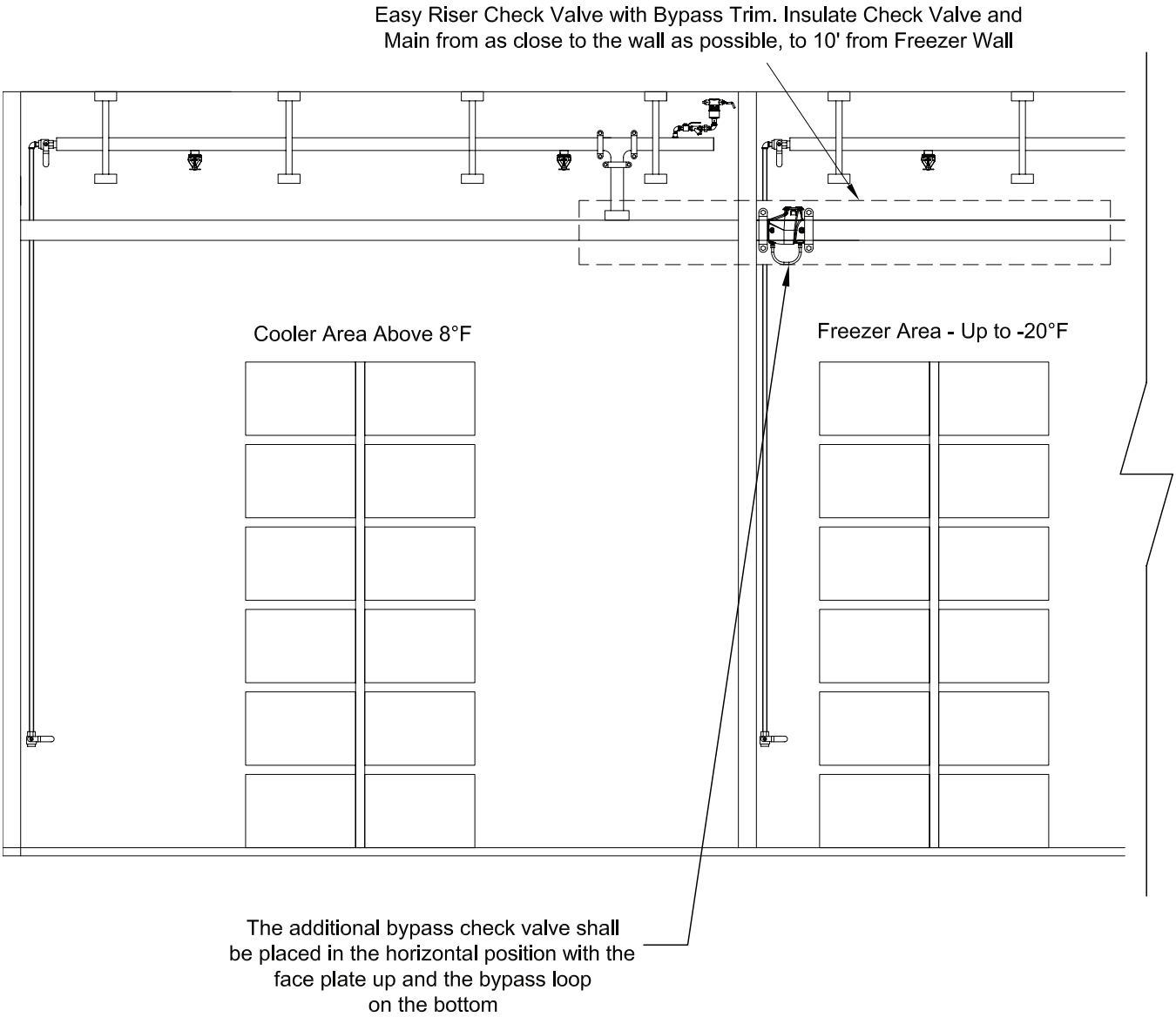
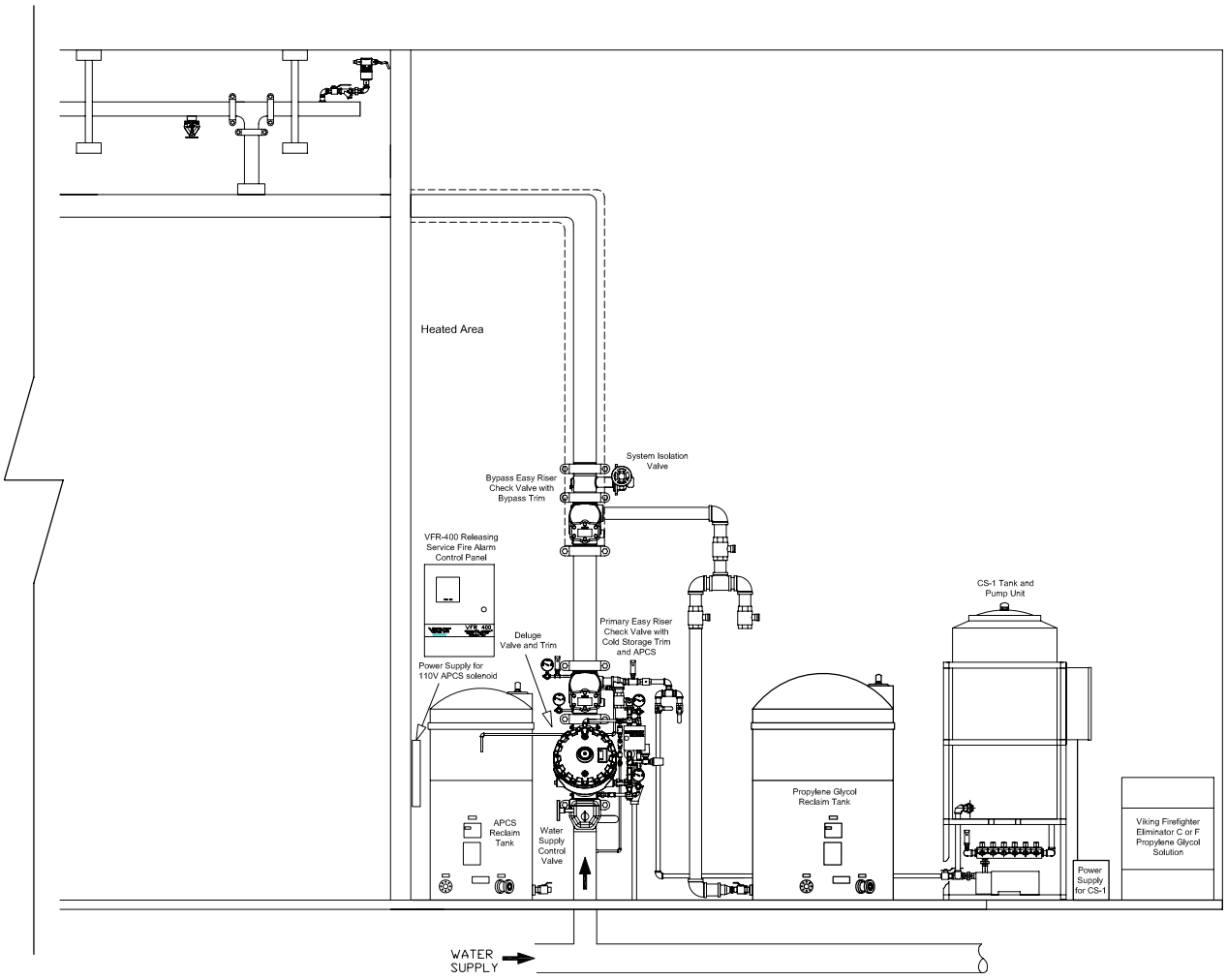

Easy Riser Check Valve with Bypass Trim. Insulate Check Valve and Main from as close to the wall as possible, to 10' from Freezer Wall
Cooler Area Above 8°F
Freezer Area - Up to -20°F
The additional bypass check valve shall be placed in the horizontal position with the face plate up and the bypass loop on the bottom

Figure 17 - Adjacent Freezer and Cooler

Where the building has separate cooler and freezer areas, it will be necessary to install additional bypass check valves to prevent thermal transfer and frosting from one area to another.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com


Heated Area
System Isolation Valve
Bypass Easy Riser Check Valve with Bypass Trim
VFR-400 Releasing Service Fire Alarm Control Panel
VFR 400
Deluge Valve and Trim
Primary Easy Riser Check Valve with Cold Storage Trim and APCS
Power Supply for 110V APCS solenoid
CS-1 Tank and Pump Unit
Propylene Glycol Reclaim Tank
APCS Reclaim Tank
Water Supply Control Valve
Viking Firefighter Eliminator C or F Propylene Glycol Solution
Power Supply for CS-1
WATER SUPPLY

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

4. Designing the Detection System

The detection system shall consist of low temperature “spot” type heat detectors, air sampling smoke detection or beam smoke detection. Linear heat detection is not suitable for this system and shall not be used.

Viking does not have a preferred manufacturer of initiating devices. Spot heat detectors are typically not subject to compatibility issues with the release control panel. Viking considers all listed and approved spot type heat detectors that the manufacturer determines is appropriate for cold storage applications acceptable. The detection system shall be designed to allow the heat detectors to operate prior to the Viking K25.2 ESFR sprinklers by selecting a lower temperature rating and RTI for the heat detector. (NFPA 13 defines an ESFR Sprinkler as having a thermal element with an RTI of 50 (meters sec.$^{1/2}$) or less.) The heat detector manufacturer shall be contacted for the heat detector RTI information.

Air sampling systems are also considered acceptable for activation of the ESFR Cold Storage System, and should be designed in accordance with the manufacturer’s instructions.

The detection system shall be designed in accordance with the requirements of NFPA 72.

5.6.2.3 Marking: Heat-sensing fire detectors shall be marked with their listed operating temperature. Spot-type heat detectors shall also be marked with their RTI (response time index). The RTI marking requirements shall have an effective date of July 1, 2008.

5.6.5.5.1 On ceilings 10 ft to 30 ft (3 m to 9.1 m) high, heat detector linear spacing shall be reduced in accordance with Table 5.6.5.5.1 prior to any additional reductions for beams, joists, or slope, where applicable.

5.6.5.5.2 The minimum spacing of heat detectors shall not be required to be less than 0.4 times the height of the ceiling.

Table 4 - Detector Classification from NFPA 72

Table 5.6.2.1.1 Temperature Classification for Heat-Sensing Fire Detectors

Temperature Classification	Temperature Rating Range		Maximum Ceiling Temperature		Color Code
	° F	° C	° F	° C	
Low*	100-134	39-57	80	28	Uncolored
Ordinary	135-174	58-79	115	47	Uncolored
Intermediate	175-249	80-121	155	69	White
High	250-324	122-162	230	111	Blue
Extra high	325-399	163-204	305	152	Red
Very extra high	400-499	205-259	380	194	Green
Ultra high	500-575	260-302	480	249	Orange

*Intended only for installation in controlled ambient areas. Units shall be marked to indicate maximum ambient installation temperature.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

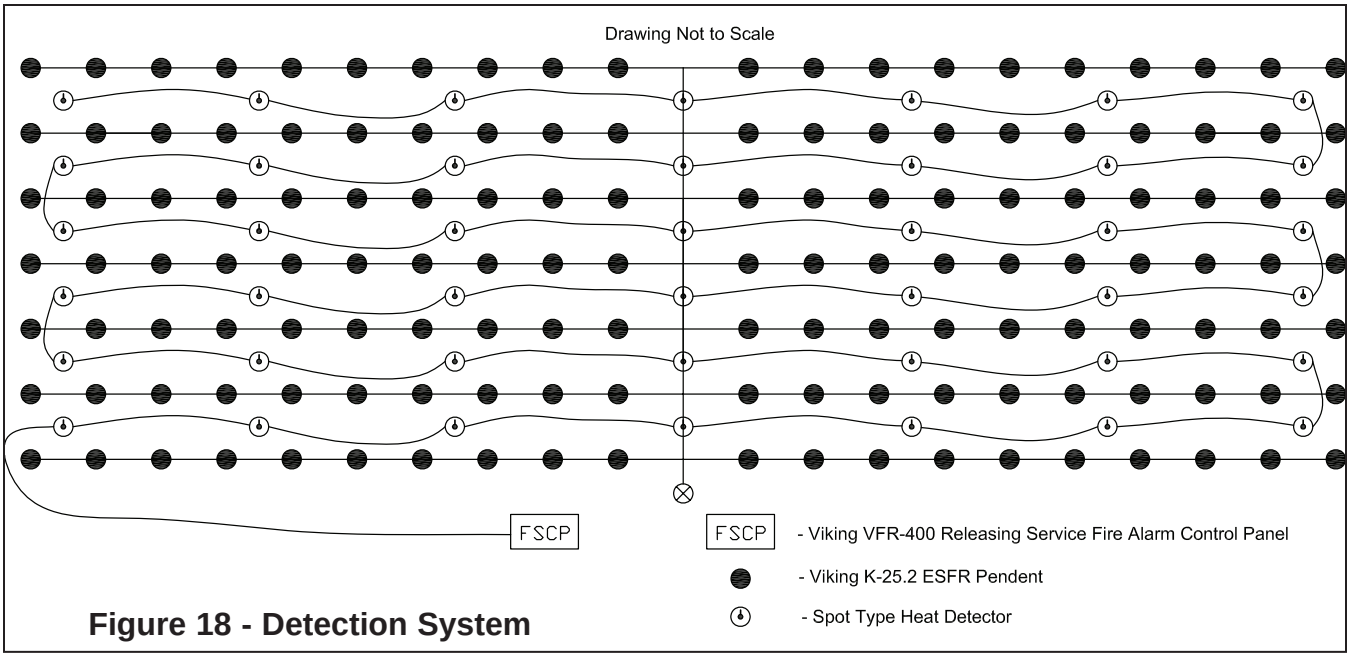

Drawing Not to Scale
FSCP
FSCP
- Viking VFR-400 Releasing Service Fire Alarm Control Panel
- Viking K-25.2 ESFR Pendent
- Spot Type Heat Detector

Figure 18 - Detection System

Table 5 - Spacing Reductions from NFPA 72

Table 5.6.5.5.1 Heat Detector Spacing Reduction Based on Ceiling Height

Ceiling Height Above		Up to and Including		Multiply Listed Spacing by
m	ft	m	ft	
0	0	3.05	10	1.00
3.05	10	3.66	12	0.91
3.66	12	4.27	14	0.84
4.27	14	4.88	16	0.77
4.88	16	5.49	18	0.71
5.49	18	6.10	20	0.64
6.10	20	6.71	22	0.58
6.71	22	7.32	24	0.52
7.32	24	7.93	26	0.46
7.93	26	8.54	28	0.40
8.54	28	9.14	30	0.34

III. INSTALLATION AND COMPONENT FUNCTIONS

Note: All materials installed on the system shall be compatible with the propylene glycol solution.

Table 6 - Propylene Glycol Compatibility Chart				
	Thermoplastics	PVC	C	A = Excellent resistance B = Fair C = Poor Information provided by The Noble Company
		CPVC	C	
		Polyethylene (PE)	B	
		Polyethylene Cross Linked (XLPE)	A	
		Teflon	A	
		ABS	B	
	Gaskets	Viton	A	
		EPDM	A	
		Neoprene	C	
		Buna N (Nitrile)	A	
		Hypalon	A	

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

1. Water Supply Control Valve

A listed indicating valve shall be installed on the upstream side of the deluge valve. The valve shall not close in less than 5 seconds when operated at maximum possible speed from the fully opened position. Valves shall conform to the requirements of NFPA 13 (8.16.1.1.2 2007 ed.):

8.16.1.1.2* Supervision.

8.16.1.1.2.1 Valves on connections to water supplies, sectional control and isolation valves, and other valves in supply pipes to sprinklers and other fixed water-based fire suppression systems shall be supervised by one of the following methods:

1) Central station, proprietary, or remote station signaling service
2) Local signaling service that will cause the sounding of an audible signal at a constantly attended point
3) Valves locked in the correct position
4) Valves located within fenced enclosures under the control of the owner, sealed in the open position, and inspected weekly as part of an approved procedure

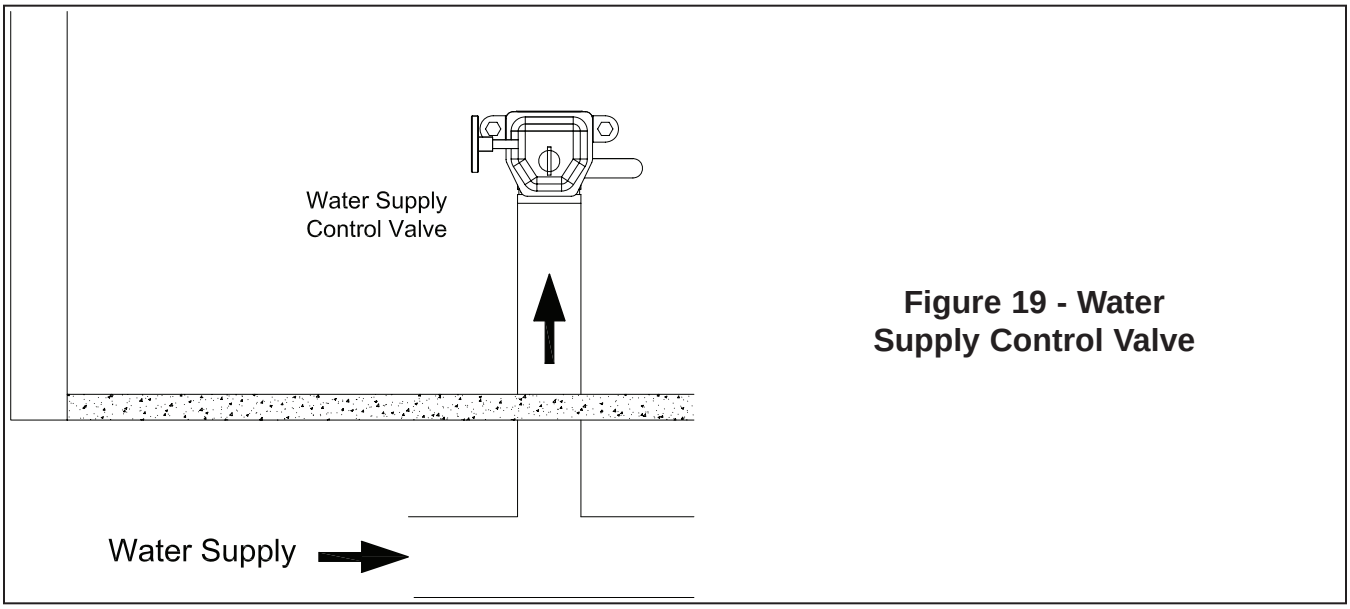


Figure 19 - Water Supply Control Valve

2. Grooved Couplings

In order to prevent leaks and preserve the antifreeze solution, it is imperative that grooved pipe ends are smooth, round, and free of burrs, flat spots, and weld seam imperfections. Also, pipes should be capped to prevent contaminant during shipping, storage, etc. Verify that any gasket materials used in couplings, etc. are compatible with the antifreeze solution. Refer to the antifreeze solution technical data page.

Where grooved couplings are used in the system, “flush seal” gasket, low temperature EPDM rubber and lube are required. Gaskets: grade “E” EPDM, NSF-61 Certified, -40 °F to 230 °F (service temperature range) (-40 °F to 110 °F) recommended for water service, diluted acids, alkalys solutions, oil-free air and many chemical services. GRUVLOK Xtrema Lubricant is required for freezer applications. In order to pervent leaks and preserve the antifreeze solution, the grooved pipe ends must be smooth, round, and free of burrs.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

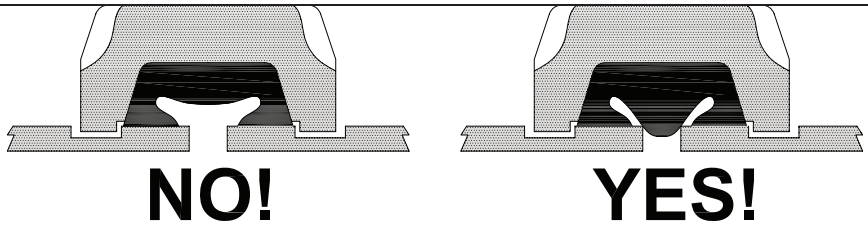


Figure 20 - Grooved Couplings

3. Deluge Valve with Conventional Trim

The ESFR Cold Storage System utilizes a Viking Model F-1 Deluge Valve. Refer to Viking Technical data pages for Valve Specifications.

The Deluge Valve is to be installed using Deluge Valve Conventional Trim. Refer to the trim drawing on the following page for details.

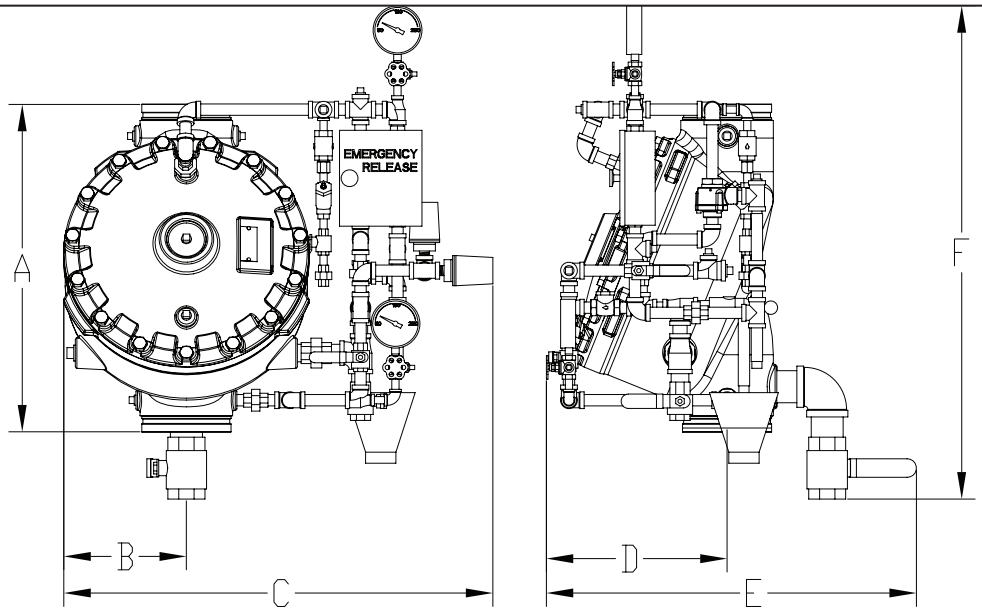


Figure 21 - Valve and Trim Dimensions

Valve Size	A	B	C	D	E	F
4”	19-1/2	7-1/4	28-1/2	13	22-7/16	34-5/8
6”	24-5/16	9-1/8	31-7/8	13-7/16	27-1/2	36-5/8
8”	29-1/2	11-1/4	35-5/16	14-1/4	19-7/8	39-1/4

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

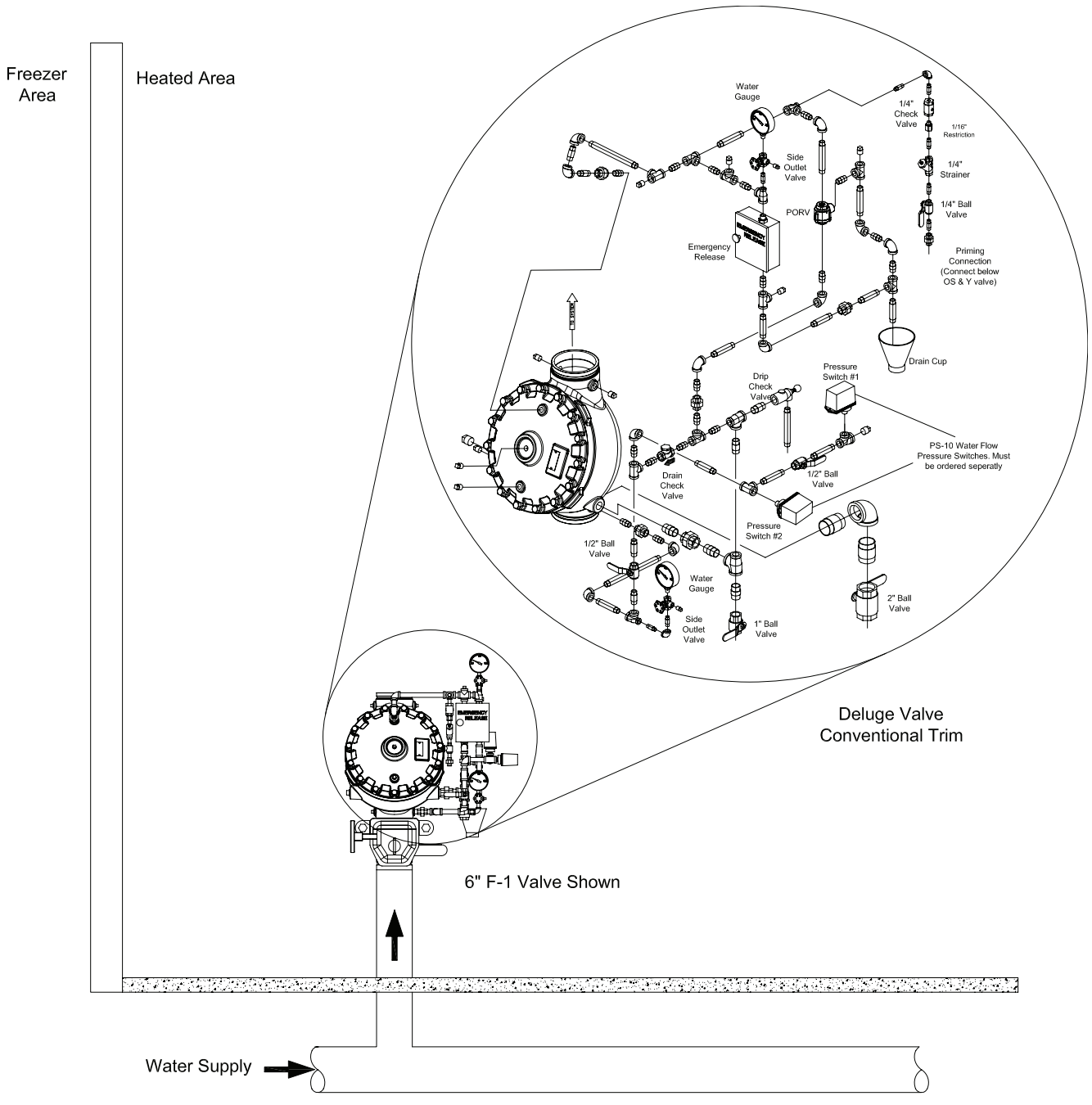


Figure 22 - Deluge Valve and Trim

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

NOTES: An alarm test connection is provided on the deluge valve trim. When testing the alarm, the downstream isolation valve (illustrated in Figure 30) and antifreeze isolation valve (illustrated in Figure 33) must be shut before opening the test valve.

This is a precaution in case the deluge valve would inadvertently operate due to problems in the trim components and cause water to enter the system causing possible contamination of antifreeze. After testing of the alarm, restore the control valves to their normal operating position and open the antifreeze supply valve.

A. Water Flow Pressure Switches (PS-10)

Each system requires 2 water flow pressure switches that transmit an alarm after the system has activated.

The Double Switch (PS-10-2A) Water Flow Pressure Switch (Switch #1) is installed on the deluge valve conventional trim. In addition to transmitting an alarm signal, Switch #1 is wired in conjunction with digital Switch #5 to prevent the solenoid valve on the CS-1 Tank and Pump Unit from opening when the water flow switch is activated. This prevents propylene glycol from entering the system when water is flowing.

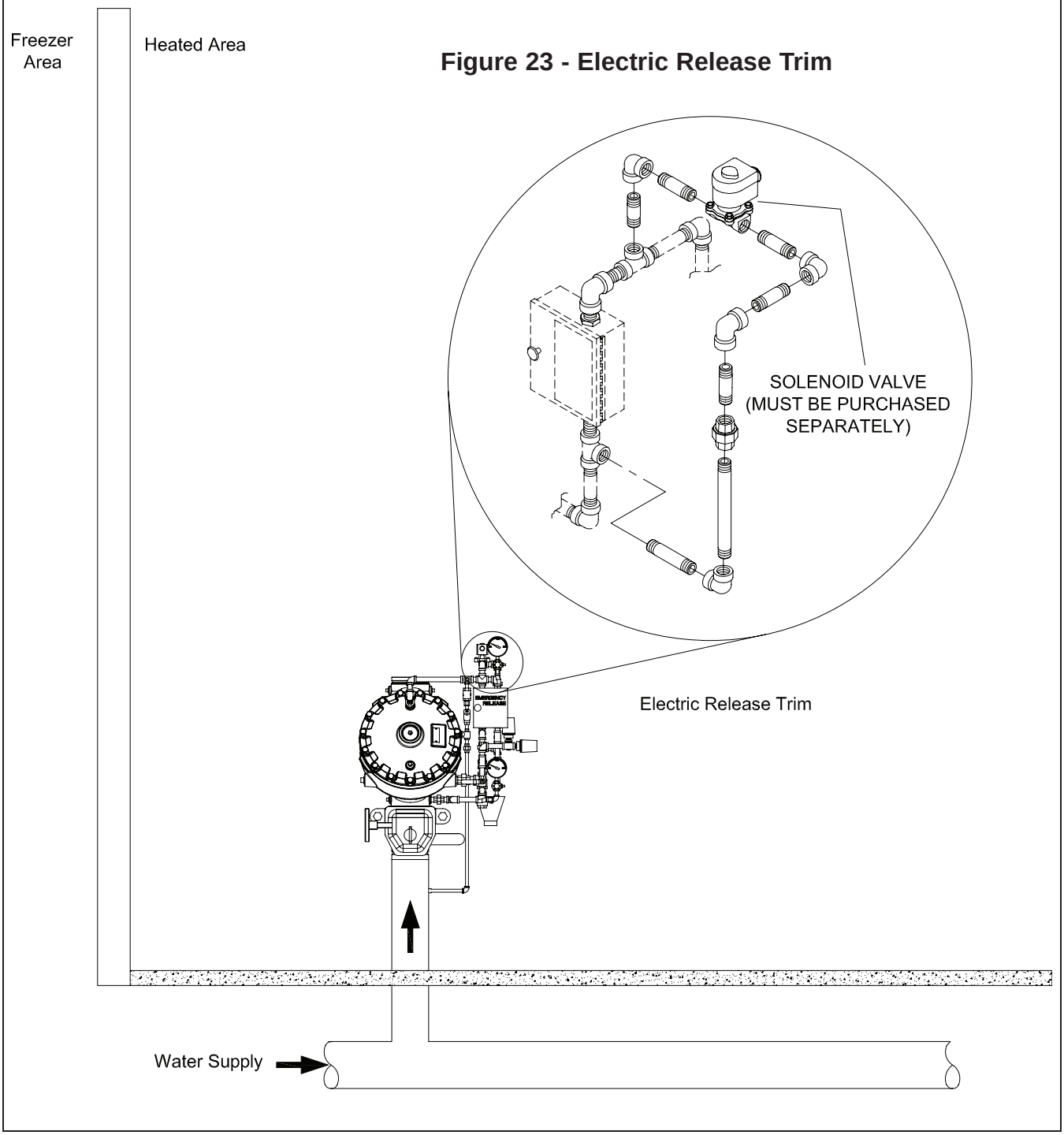
The Single Switch (PS-10-1A) Water Flow Pressure Switch (Switch #2) is installed on the deluge valve conventional trim. Switch #2 is wired in conjunction with Digital Pressure Switch #4 in order to prevent the operation of the APCS during system operation.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

4. Electric Release Trim

A standard Deluge Electric Release Trim Package is required to be installed onto the Deluge Conventional Trim. The Electric Release Trim Package includes all of the necessary pipe and fittings to install the release solenoid to the Valve Trim. The Solenoid Valve is **NOT** included and must be ordered separately.

Figure 23 - Electric Release Trim



The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

5. Easy Riser® Check Valve with Cold Storage Trim

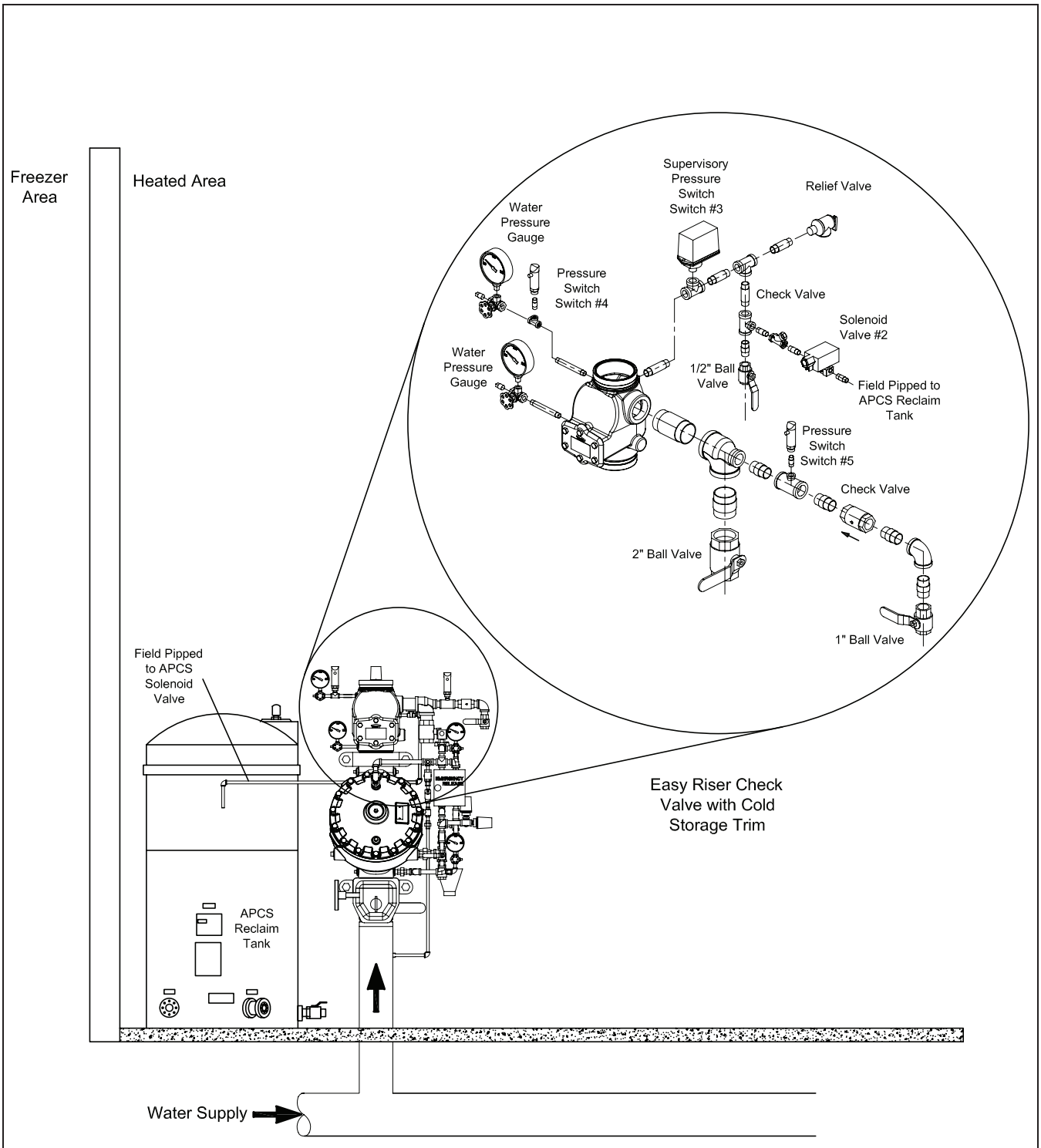


Figure 24 - Easy Riser® Check Valve with Cold Storage Trim

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

A. Cold Storage Trim with Automatic Pressure Control System

In cold storage areas where temperatures can fluctuate, over-pressurization of the system can occur. The Automatic Pressure Control System (APCS) is used to prevent this from occurring. The pressure relief valve (PRV) operates when the set point of 205 PSI (14.1 Bar) is reached. Normal operation of the PRV includes operation at 90-105% of the set point and closing at 80% of the set point. The Automatic Pressure Control System (APCS) is designed to maintain a safe operating pressure below the set point of the PRV and above the maximum residual or static pressure of water supply system or maximum set pressure of the system pressure switch. The Automatic Pressure Control Trim is included with the Easy Riser® Cold Storage Trim and installed on the primary Easy Riser® Check Valve.

The APCS includes an electronic digital pressure switch that includes a normally open SPST switch that is set to close at a pressure below the PRV set point and open above the static water supply or shut-off pressure of the riser system. A waterflow switch is to be installed on the non-interruptible alarm port of the conventional trim on the deluge valve. A normally closed solenoid valve is to be installed on the cold storage trim at the ¼" connection provided. A 115-220 VAC, (50 or 60 Hz) GFI protected electrical power supply is to be provided directly to the switch.

During normal operating condition, the propylene glycol within the system piping network is pressurized to 50 PSI (3.45 Bar). The APCS uses a digital pressure switch (Switch #4) in conjunction with a 120 VAC solenoid (Switch #2) to relieve pressure from the system when the pressure exceeds 85 PSI (5.86 Bar). The digital pressure switch (#4) comes factory set to operate and energize the solenoid (#2) at 85 PSI (5.86 Bar). The digital pressure switch will change state and remove power from the solenoid (#2) at 75 PSI (5.17 Bar).

The digital pressure switch (#4) and solenoid (#2) are wired and powered from a dedicated 115-220 VAC (50 or 60 Hz) GFI protected power supply and routed through a water flow pressure switch (#2) as shown in Figure 39. These devices operate independently and are not connected to either the release control panel or the CS-1 tank and pump unit. The normally closed water flow pressure switch prevents the APCS from operating under normal water flow conditions.

The pressure switch on the deluge valve will make the APCS inoperable when the detection system causes the deluge valve to open. This prevents water flow from the APCS.

1. Supervisory Pressure Switch (PS-40)

The Automatic Pressure Control System includes a PS-40 Supervisory Pressure Switch that is installed on the primary Easy Riser® Check Valve and wired to the appropriate supervisory circuit on the Viking VFR-400 to annunciate a supervisory signal upon a low pressure condition with the propylene glycol. It is recommended to set the switch to activate at 30 PSI (2.07 Bar).

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

6. Digital Pressure Switch

A. Description

Viking Supervisory Pressure Switches (#4, 5, & 6) are factory programmed electronic digital pressure switches installed in three locations of the ESFR Cold Storage System. The pressure switches are designed to initiate an electric signal at a predetermined low pressure setting or a predetermined high pressure setting to maintain system antifreeze solution pressure, relieve high pressure or start the CS-1 Pump. Viking Supervisory Pressure Switches are SPDT pressure transducer switches. The Switches show the current pressure on the LED display

The pressure switches are used in each of the following locations (refer to Figure 25):

- On the Automatic Pressure Control System (Switch #4) (Included with Cold Storage Trim)
- On the system riser to control the solenoid valve (Switch #5) (Must be ordered separately)
- On the CS-1 pump unit to control the pump (Switch #6) (Included with CS-1 Tank and Pump)

B. Technical Data

Factory Settings:	Switch # 4 (N/O)	Switch # 5 (N/C)	Switch # 6 (N/C)
Cut-Out:	75 PSI (5.17 Bar)	50 PSI (3.45 Bar)	75 PSI (5.17 Bar)
Cut-In:	85 PSI (5.86 Bar)	40 PSI (2.76 Bar)	45 PSI (3.1 Bar)

Specifications:

Dimensions: 1-7/8” (48 mm) W x 4-3/4” (120 mm) H (See Figure 25)
Pressure Connection: ¼” female NPT
Electrical Connection: ½” UNF-Connector, angled design
Maximum System Pressure: 175 PSI (12 Bar)
Voltage: 85-265 AC (45-65 HZ)
Current Rating [mA]:
2.5A @ 68 °F (20 °C)
1.5A @ 113 °F (45 °C)
1A @ 140 °F (60 °C)
0.25A @ 158 °F (70 °C)
Current Consumption: < 10 mA
Protection: IP65, Protection Class: II
Operating Temperature: -13 °F (-25 °C) to 176 °F (80 °C)
Not for use in hazardous locations
Cable Part Number 13231 is 13 ft (4 m) long

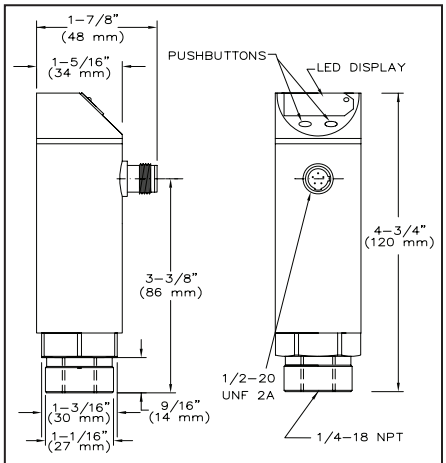


Figure 25 - Switch Dimensions

Material Standards:

Stainless Steel (303S22), ceramics; FPM (Viton)
Housing: EPDM/X (Santoprene), FPM (Viton), PA, Pocan, PC (Macrolon), Stainless Steel (304S15)
Body: TPU (urethane)

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

Figure 26 - Digital Pressure Switch Locations

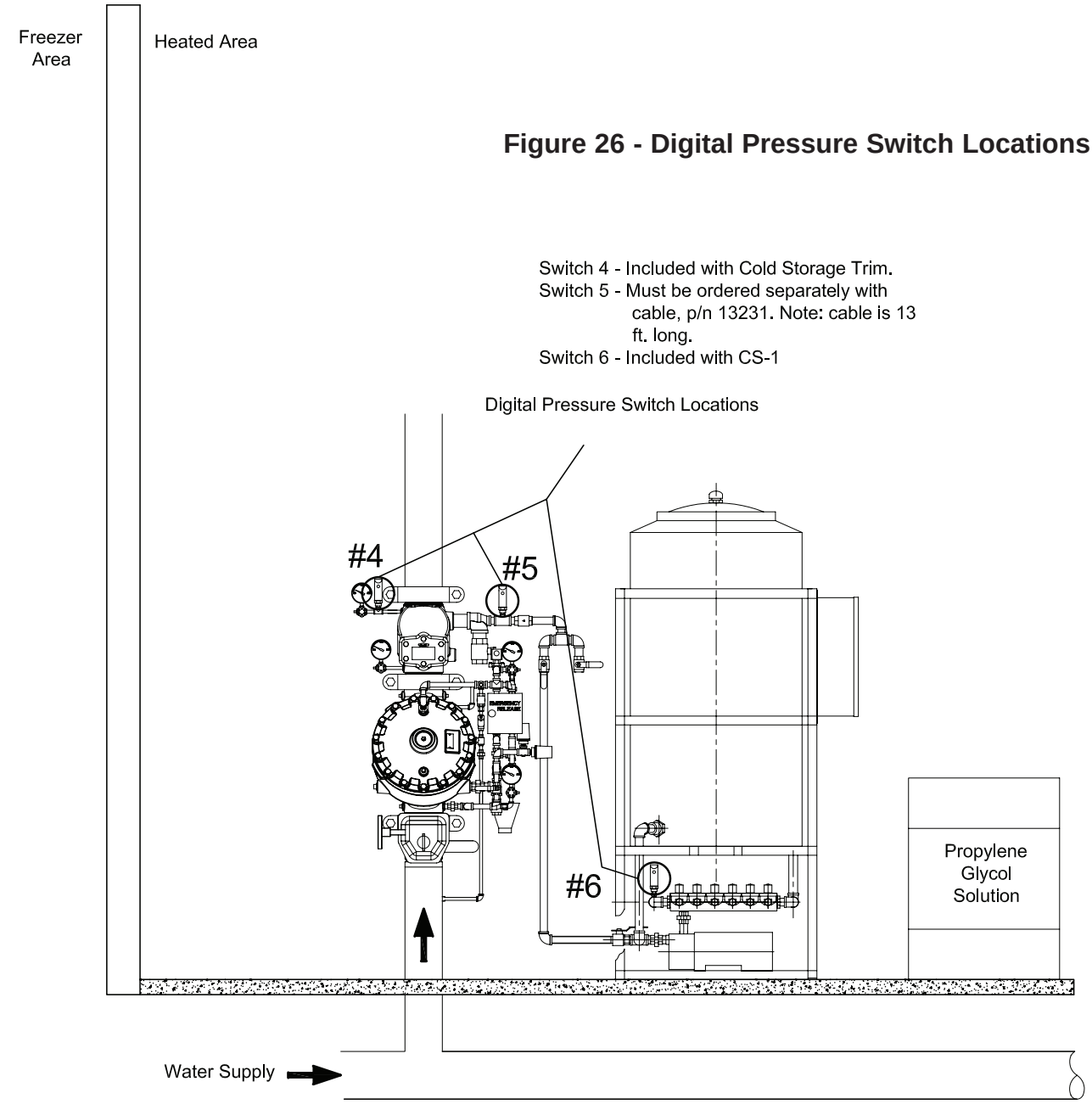
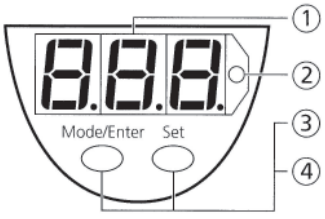

Freezer Area
Heated Area
Switch 4 - Included with Cold Storage Trim.
Switch 5 - Must be ordered separately with cable, p/n 13231. Note: cable is 13 ft. long.
Switch 6 - Included with CS-1
Digital Pressure Switch Locations
#4
#5
#6
Propylene Glycol Solution
Water Supply

Figure 27: Controls and Visual Indication



1	LED display	Display of the system pressure, display of parameters and parameter values.
2	LED red	Switching status; lights if the output has switched
3	Mode/Enter button	Selection of the parameters and acknowledgment of the parameter values.
4	Set button	Setting of the parameter values (scrolling by holding pressed; incremental by pressing briefly)

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

Nut: Brass, nickel plated

Wrench Flats: 30 mm

Ordering Information:

Part Numbers: Switch - 13057 (Must be ordered for Switch #5)
Cable - 13231

C. Operating Modes

Run Mode (normal operating mode):
When the supply voltage has been applied, the unit is in the Run mode. It monitors and switches the output according to the set parameters. The display shows the current system pressure. The red LED indicates the switching state of the output.

Display Mode (indication of parameters and the set parameter values):
When the “Mode/Enter” button is pressed for a short time, the unit passes to the Display mode. Internally it remains in the operating mode. The parameter names are scrolled with each pressing of the “Mode/Enter” button. When the “Set” button is pressed for a short time, the corresponding parameter value is displayed for approximately 15 seconds. Then the unit returns to the Run mode.

Locking / Unlocking
The units are electronically locked to prevent unwanted adjustment of the set parameters; Press (in Run mode) both setting buttons for 10 seconds. As soon as the indication goes out, the unit is locked or unlocked. Units are delivered from the factory in the locked state. With the unit in the locked state, “Loc” is indicated briefly when you try to change parameter values.

D. Installation

Before installing or removing a pressure switch, make sure that no pressure is applied to the system.

1. When installing the switch, apply Teflon tape sealant to the male threads only.
2. Install the Supervisory Pressure Switch in the ¼” NPT connection. Use a wrench applied to the wrench flats to tighten the unit. Do not over-tighten. Mount the switch in the upright position (threaded connection down).
3. To wire the unit proceed as follows:
   a. De-energize electrical circuits involved.
   b. Connect cable (Viking Part No. 13213) to the ½” conduit opening provided.
   c. Connect electrical circuitry for the signalling device and auxiliary equipment being controlled by the switch. Refer to the wiring diagrams. Wire all devices to national and local codes and requirements of the Authority Having Jurisdiction.
4. Energize the circuits.

1. Electrical Connection:

The unit must only be connected by a certified electrician. National and international regulations for the installation of electrical equipment must be observed. Caution: For the output circuit, the same protective measures as for the supply circuit must be taken. A 115 VAC (60 HZ) or 220 VAC (50 HZ) electrical power supply is to be provided directly to the switch when used for APCS. Alternately, connect to the CS-1 panel. When used for system control, direct connection to the switch must be made with Viking Cable Part No. 13231.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

E. Inspections, Tests and Maintenance

Operate and test the Supervisory Pressure Switch after installation, prior to start-up, and periodically as required in the Viking technical data pages, the installation standards, and/or the Authority Having Jurisdiction. Quarterly testing of Pressure Supervisory Switches is recommended. Refer to ESFR Cold Storage System data page 45a-j for testing requirements and procedures.

NOTICE: The owner is responsible for maintaining the fire-protection system and devices in proper operating condition. For minimum maintenance and inspection requirements, refer to NFPA 25 and Viking's ESFR Cold Storage System Manual.

1. Periodic Test and Maintenance

Caution: For auxiliary equipment controlled by operation of the switch, take the steps necessary to prevent unwanted operation or shutdown of those devices when testing.

Warning: Any system maintenance that involves placing a control valve or detection system out of service may eliminate the fire-protection capabilities of that system. Prior to proceeding, notify all Authorities Having Jurisdiction. Consideration should be given to employment of a fire patrol in the affected areas.

1. Refer to Viking technical data page 45a-j and the ESFR Cold Storage System Manual for testing and maintenance instructions.
2. If test is satisfactory, reset all necessary equipment, and place the system in service.

2. Supervisory Switch Adjustment

Consult the ESFR Cold Storage System technical data pages for recommended pressure settings for each location where the Supervisory Pressure Switch is installed on the system. The switches are factory set. If adjustment is necessary, proceed according to the instructions given below.

1. If the unit is in the locked state, "Loc" is indicated briefly when you try to change parameter values, press (in Run mode) both setting buttons for 10 seconds. As soon as the indication goes out, the unit is unlocked.
2. Verify pressure settings of the switch.
3. Test for proper operation of the device.
4. The unit can be electronically locked to prevent unwanted adjustment of the set parameters; Press (in Run mode) both setting buttons for 10 seconds. As soon as the indication goes out, the unit is locked. With the unit in the locked state, "Loc" is indicated briefly when you try to change parameter values.
5. Reset all necessary equipment and place the system in service. Refer to the ESFR Cold Storage System technical data pages.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

7. Propylene Glycol Solution Reclaim Tank

Viking recommends a reclaim tank with at least the capacity of the largest system be available for system draining. The system drain piping should be arranged to discharge to the reclaim tank. In addition, (1) smaller reclaim tank for all systems should be installed and connected to the pressure relief valve on the automatic pressure control system.

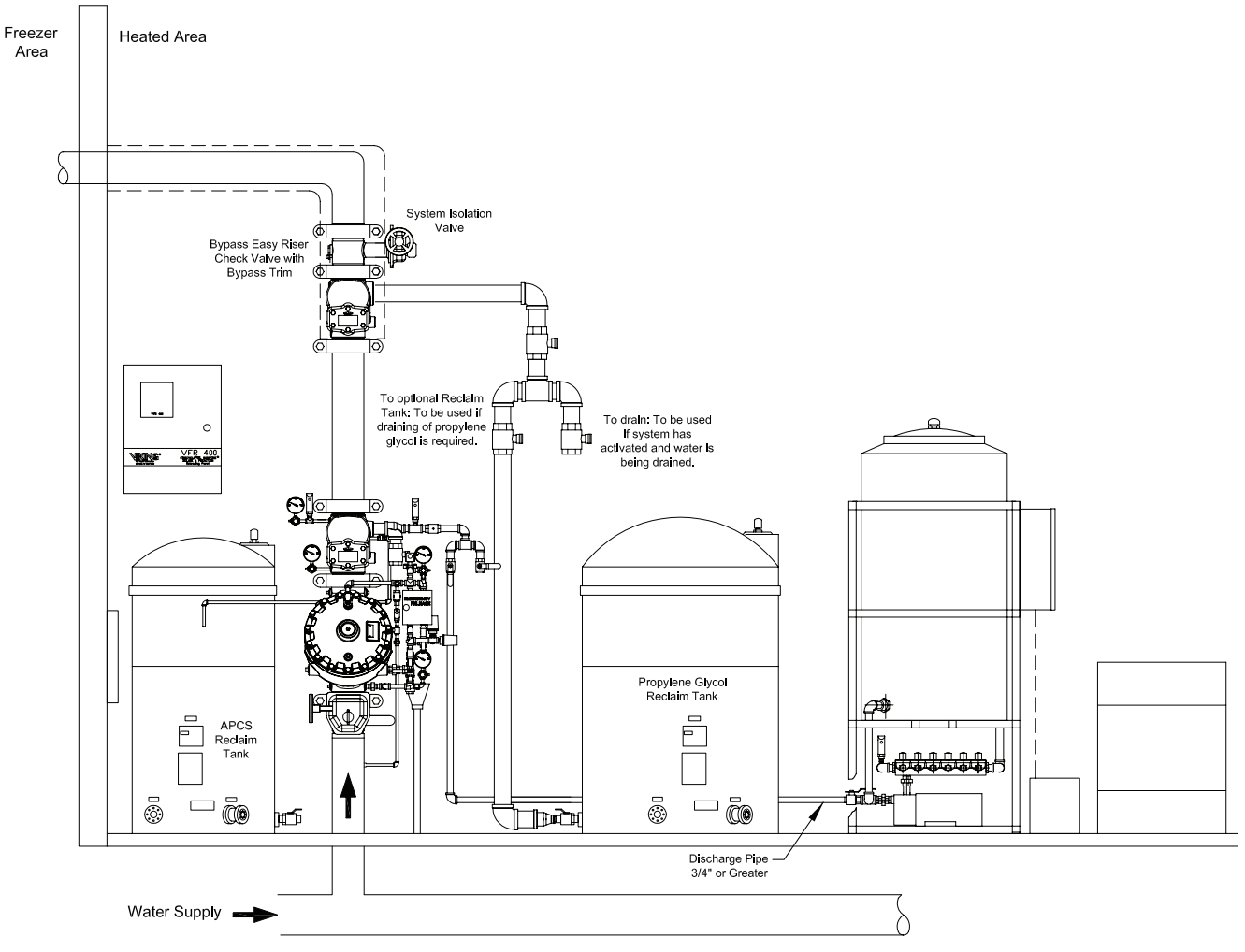

Freezer Area
Heated Area
System Isolation Valve
Bypass Easy Riser Check Valve with Bypass Trim
To optional Reclaim Tank: To be used if draining of propylene glycol is required.
To drain: To be used If system has activated and water is being drained.
VFR 400
APCS Reclaim Tank
Propylene Glycol Reclaim Tank
Discharge Pipe 3/4" or Greater
Water Supply

Figure 28 - Propylene Glycol Reclaim Tank

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

8. Bypass Easy Riser® Check Valve with Bypass Trim

A second Easy Riser® Check Valve is required to be installed above the Primary Easy Riser Check Valve. The Isolation Check Valve is identical to the Primary Easy Riser Check Valve, but requires bypass trim.

The bypass Easy Riser® Check Valve is installed to “dead head” thermal transfer from a cold area to a warm area or a warm area to a cold area in the case of installations in both coolers and freezers. Frost is likely to occur on the piping downstream of the bypass Easy Riser Check Valve. This piping and bypass check valve must be insulated with standard freezer insulation. In situations where the valve is installed in the horizontal position, it must be installed with the face plate facing up.

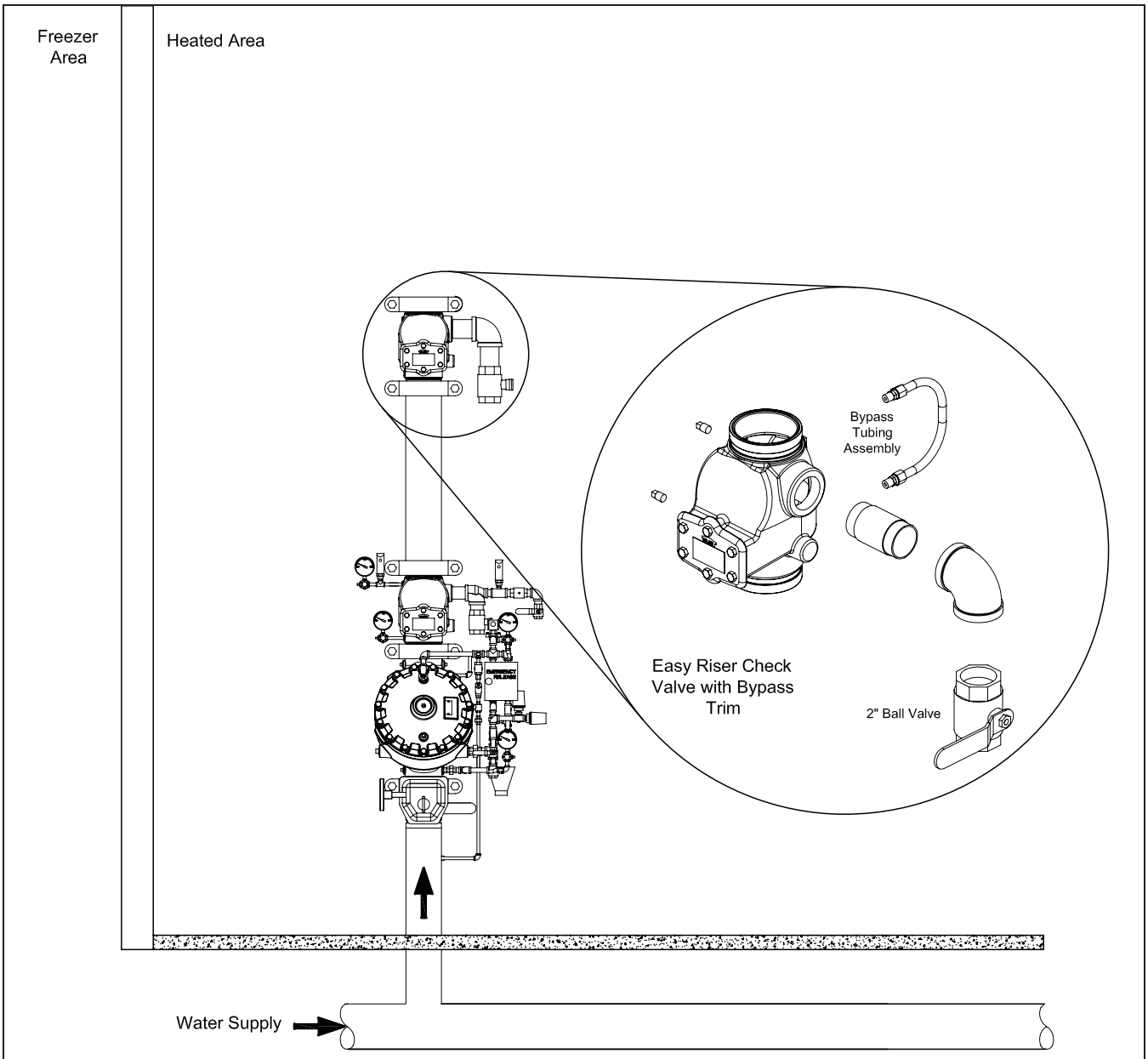


Figure 29 - Easy Riser Check Valve with Bypass Trim

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

A. Installation

The wiring diagram shown in Figure 39 should be used for installation of the switches and solenoid valve. In order to wire the pressure switches and solenoid valve to the power supply, a NEMA 4 junction box and conduit components are required from the junction box to solenoid valve. A special cable included with the package is required for connection to the digital switch.

The electric power supply required is 115-220 VAC, 50 or 60 Hz GFI protected. The supply wire from digital switch to solenoi valve shall be wired through the non-interupted N.C. alarm pressure swtich. See Figure 39 diagram.

9. Downstream System Isolation Valve

The downstream System Isolation Valve allows the user to isolate the propylene glycol in the system during system maintenance and testing procedures. If this valve is not installed, the propylene glycol solution will be entirely drained from the system even in situations where such drainage may not be desirable. The valve must be supervised in accordance with NFPA 13.

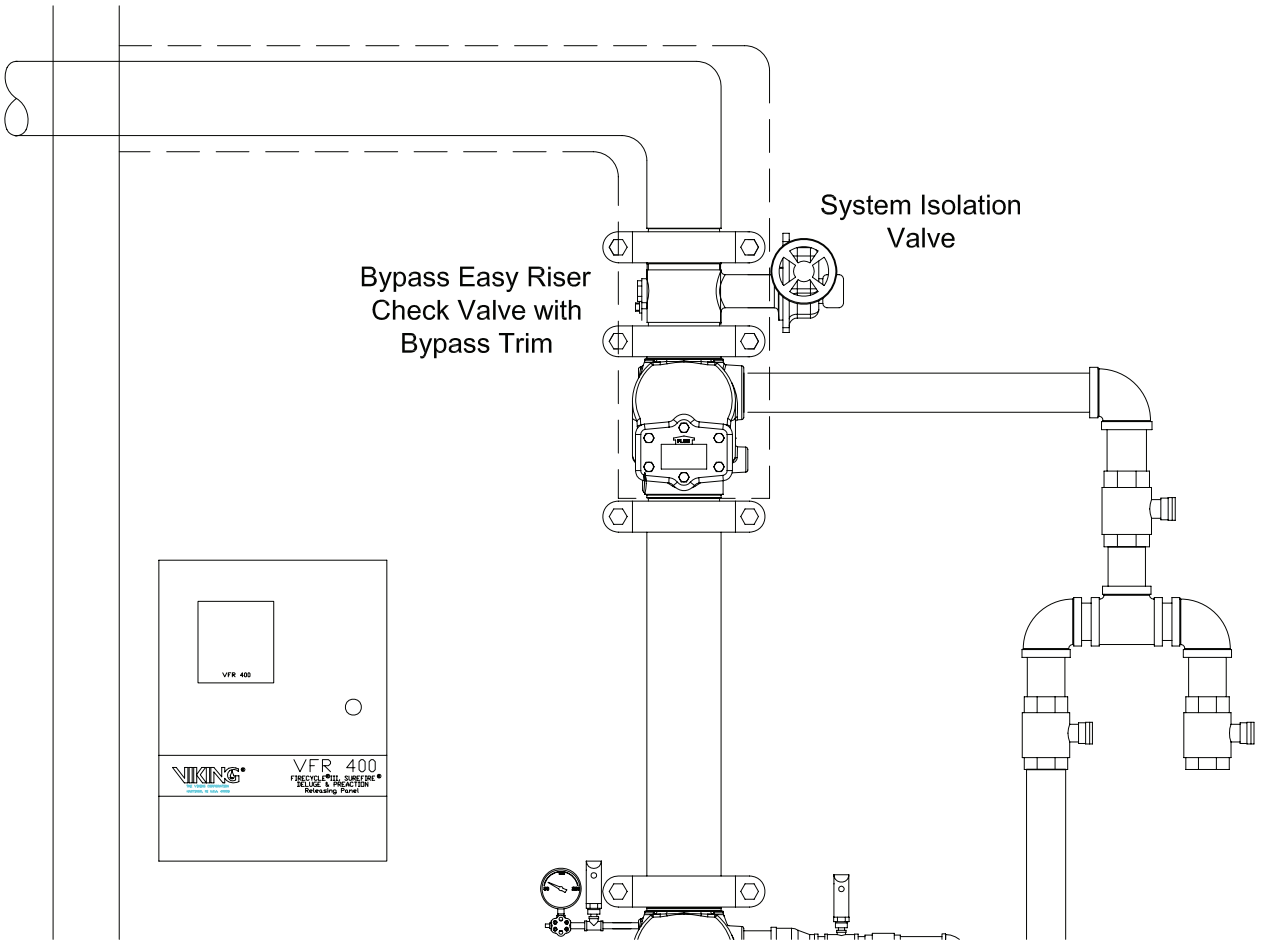


Figure 30 - Downstream System Isolation Valve

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

10. CS-1 Tank & Pump Unit

A. Description

The Viking CS-1 Tank and Pump Package is an integrated storage tank and pumping system. The tank and pump system automatically maintains the supervisory solution pressure in the piping system above the supervisory alarm pressure until the detection system and sprinkler is activated. The pump uses propylene glycol solution in the storage tank to maintain system pressure and make up for minor system leaks.

The system is designed to accept up to 50% propylene glycol and water premix solution. It is recommended that certified premix be used. Do not mix different antifreeze solutions within the system.

WARNING: Motors, electrical equipment, and controls can cause electrical arcs that will ignite a flammable gas or vapor. Never operate or repair in or near a flammable gas, vapor, excessive dust or steam. Never store flammable liquids or gases near the unit.

Safety:

This equipment is designed to be safe in the use for which it was planned, provided it is installed, started up, operated, and maintained in accordance with the instructions in this manual. Therefore, all personnel who install, use, or maintain the equipment must understand this manual. The unit contains electrical components that operate at line voltage and moving parts. Before working on the unit, isolate and lock it out from the electrical supply. All maintenance operations must be performed by qualified persons who have knowledge in the necessary precautions.

Table 7 - Ordering Information

US Power Supply Option (60 Hz)					International Power Supply Option (50 Hz)				
Part Number*	**Risers**	**Tank Size**	**Solenoid Valves**	**Control Relays**	**Part Number***	**Risers**	**Tank Size**	**Solenoid Valves**	**Control Relays**
13050-1	1	65 gal (246 L)	1	1	**13051-1**	1	65 gal (246 L)	1	1
13050-2	2	65 gal (246 L)	2	2	**13051-2**	2	65 gal (246 L)	2	2
13050-3	3	160 gal (606 L)	3	3	**13051-3**	3	160 gal (606 L)	3	3
13050-4	4	160 gal (606 L)	4	4	**13051-4**	4	160 gal (606 L)	4	4
13050-5	5	160 gal (606 L)	5	5	**13051-5**	5	160 gal (606 L)	5	5
13050-6	6	160 gal (606 L)	6	6	**13051-6**	6	160 gal (606 L)	6	6
US Power Supply Voltage suffixes: A = 208 V, B = 230 V, C = 460 V, D = 575 V.					International Power Supply Voltage suffixes: E = 380V				
*Add voltage suffix after part number					The pump furnished in all units is 3 HP, 3 Phase.				

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

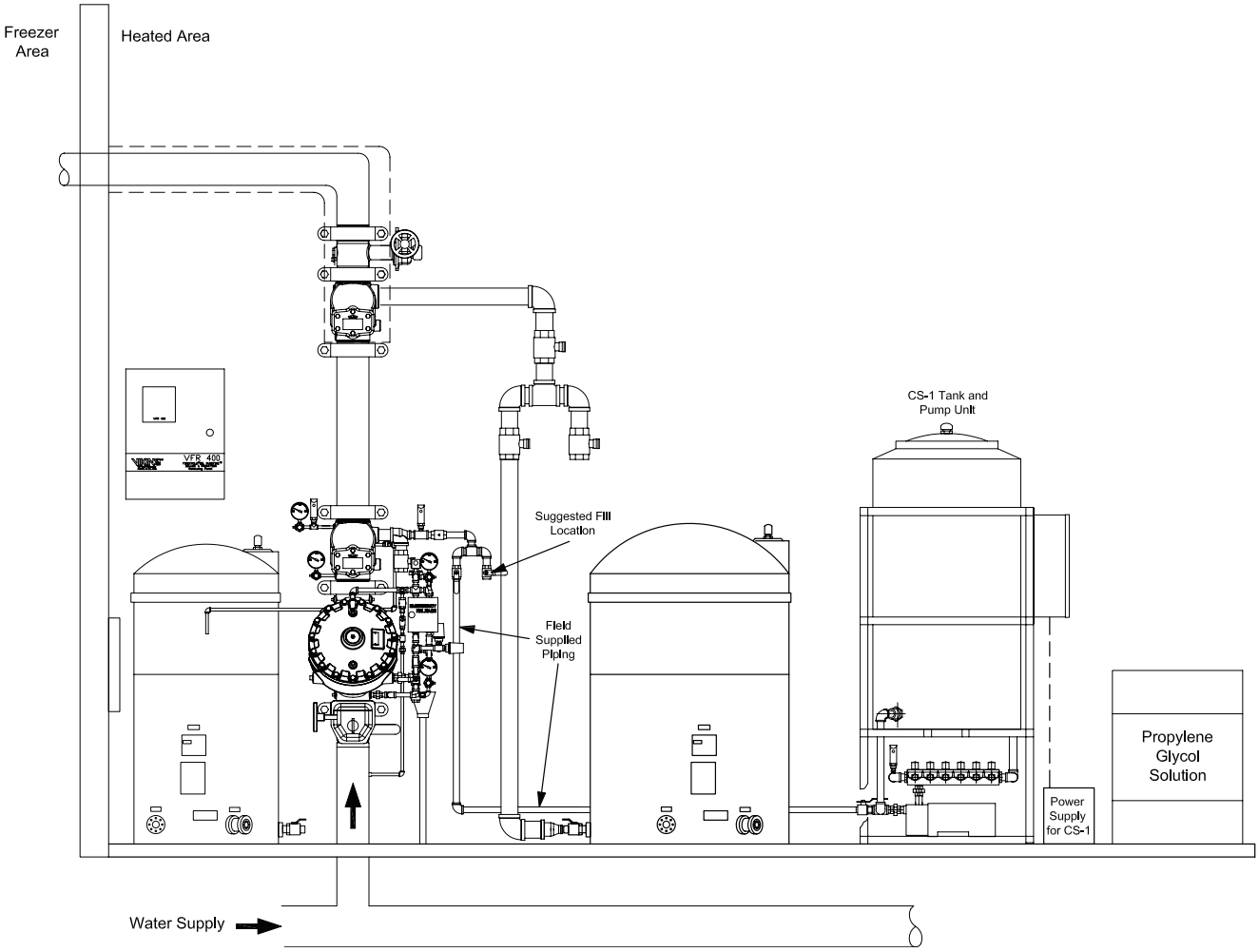


Figure 31 - CS-1 Tank and Pump Package

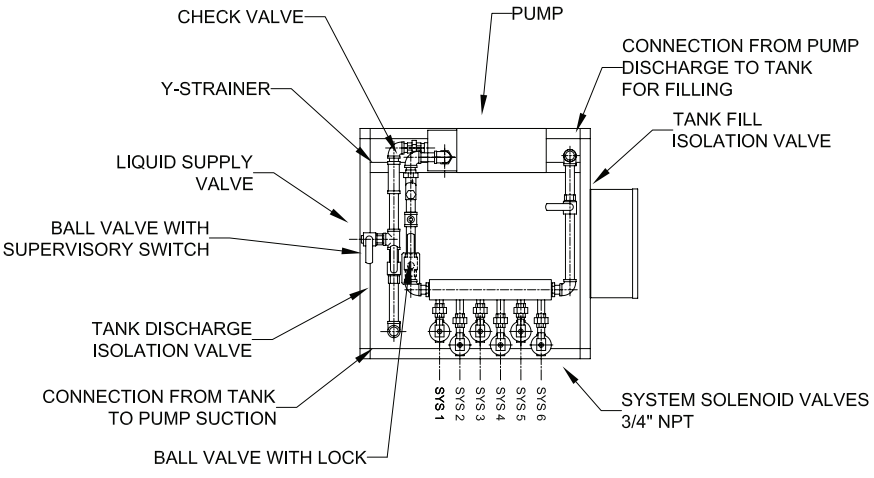


Figure 32 - Top View with Upper Frame and Tank Removed

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

B. Technical Data

NOTE: The pressure switch (#6) on the CS-1 pump unit is factory set at cut-in pressure and cut-out pressure. The pressure downstream of the Easy Riser® Check Valve is maintained at 50 PSI Max to 35 PSI Min. (3.4 bar - 2.4 bar) by digital pressure switch (#5).

C. Installation

1. Handling

Move the CS-1 on the shipping pallet as close to the final location as possible. Always lift the unit from underneath. Never lift the unit when it is full of liquid. Personal injury and/or equipment damage could result.

Ensure that all equipment used to lift the CS-1 is capable of lifting the weight. Nylon straps and soft rigging devices should be used whenever possible to protect the components and finish.

If the unit is being transported overhead, be sure that all personnel are alerted and safety procedures are followed.

2. Location

Install the CS-1 indoors in a clean, dry, non-corrosive environment. This equipment is not to be installed outdoors exposed to the weather. Position the CS-1 in an upright position on a solid, level, vibration-free surface capable of supporting the weight of the unit and liquid in the tank. Bolt the unit to the floor using the bolt holes provided in the frame. Always shim the unit level before bolting it to the floor. Install the CS-1 in a protected, well-ventilated area where the ambient temperatures are between 40 °F and 100 °F (4.4 °C to 37.8 °C).

Locate the CS-1 to allow access to supply and discharge connections. Clearance around the unit should be at least 24” (610 mm) on all sides for maintenance. Some jurisdictions require specific clearances around equipment. Check with all local Authorities to ensure compliance with applicable state, local, and national codes.

3. Piping and Connections

A slight downward slope from the supply container to the CS-1 supply valve connection is recommended to maintain positive head on the pump inlet.

Always use a backup wrench when making piping connections to avoid damage to the unit’s piping.

Size piping between the CS-1 and the system 3/4” or greater to minimize pressure drop. Clean black pipe is acceptable. Too small of a line size restricts pump flow and causes excessive back pressure, lowering capacity when filling the system. Lower capacity while filling the system requires longer fill times. If the pump stops before obtaining set system pressure, the CS-1 setting will require being increased. The sprinkler system must contain air vent/bleed valves at all local high points. These are used to let air out of the system while filling with antifreeze. Consult the system instructions for specifics.

Individual check valves and isolation valves are required for each system. This allows system maintenance without disturbing other systems the CS-1 is connected to.

Piping and/or hoses from the antifreeze supply containers to the unit should be sloped downhill slightly to provide positive head on the pump suction connection. These lines should be as large as possible and as short as possible to provide unrestricted flow to the

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

pump while filling. A separate shut-off valve in the supply line is required.

Unit piping is copper, brass and bronze. An aluminum manifold is included for mounting multiple system solenoids. Use dielectric unions to isolate copper piping from iron piping, if used, to reduce the possibility of electrolytic action on pipes and other components.

All pipes should be de-burred and threaded to a proper depth and length before installation. Threads should be inspected for cleanliness and depth of cut. Good quality pipe compound should be used to ensure a good, leak-tight fit of piping components.

NOTE: Pipe must be supported separately from the CS-1. At no time should the CS-1 support the weight or load of the pipe. Acceptable pipe mounting devices would be unistrut supports anchored to walls, hangers suspended from ceilings, or pedestals mounted from the floor. Be sure all pipe installation conforms to all building and fire codes.

4. Electrical Connections

SERIOUS PERSONAL INJURY AND DAMAGE TO THE CS-1 WILL OCCUR IF IT IS CONNECTED TO A POWER SOURCE OTHER THAN THE VOLTAGE LISTED ON THE DATA TAG. THE MANUFACTURER IS NOT LIABLE FOR DAMAGE DUE TO IMPROPER WIRING, PROTECTION, OR ELECTRICAL SERVICE INSTALLATION.

When installing electrical service to this machine, comply with the National Electric Code as well as state and local building codes.

Failure to install the proper electrical protection can result in personal injury, fire, equipment damage or death. The manufacturer is not responsible for damage or injury caused by lack of or improperly installed electrical protection.

Electrical connection to the unit is made in the control enclosure. Connect appropriate supply power to the terminals provided. The supply wire must be of adequate size and no other equipment should be connected to the same circuit. An arrow on the pump indicates the correct direction of rotation. If the pump rotates in the opposite direction, reverse the rotation of the motor. Interchanging any two incoming 3-phase supply wires reverses rotation of 3-phase motors.

WARNING: Operating the pump in the wrong direction may damage the pump. Verify pump rotation is correct before placing the unit in service. Make sure there is liquid on the suction side of the pump before checking rotation.

Connect system inputs to the proper terminals in the CS-1 control enclosure. Each system pressure switch and alarm flow switch are connected as shown on the electrical schematic.

NOTE: All system inputs must be connected before operating the unit. System valves will not respond unless the system pressure switch and flow alarm switch are connected correctly.

5. Start-Up

The following points must be verified before putting the unit into service. Correct any discrepancies before operating the unit:

- The unit is bolted to a firm level surface.
- Area temperature will always remain between 40 °F and 100 °F (4.4 °C to 37.8 °C).

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

- Dielectric unions, if needed, are installed between the pump station piping and system piping.
- All piping to and from the pump station is independently supported and does not place any strain on the unit's piping.
- Power supplied to the unit is appropriate.
- Pump rotation has been checked and is correct.
- System inputs are connected according to the electrical schematic. All pressure switches are set or programmed correctly.
- Air can be vented from the system when filling with antifreeze.

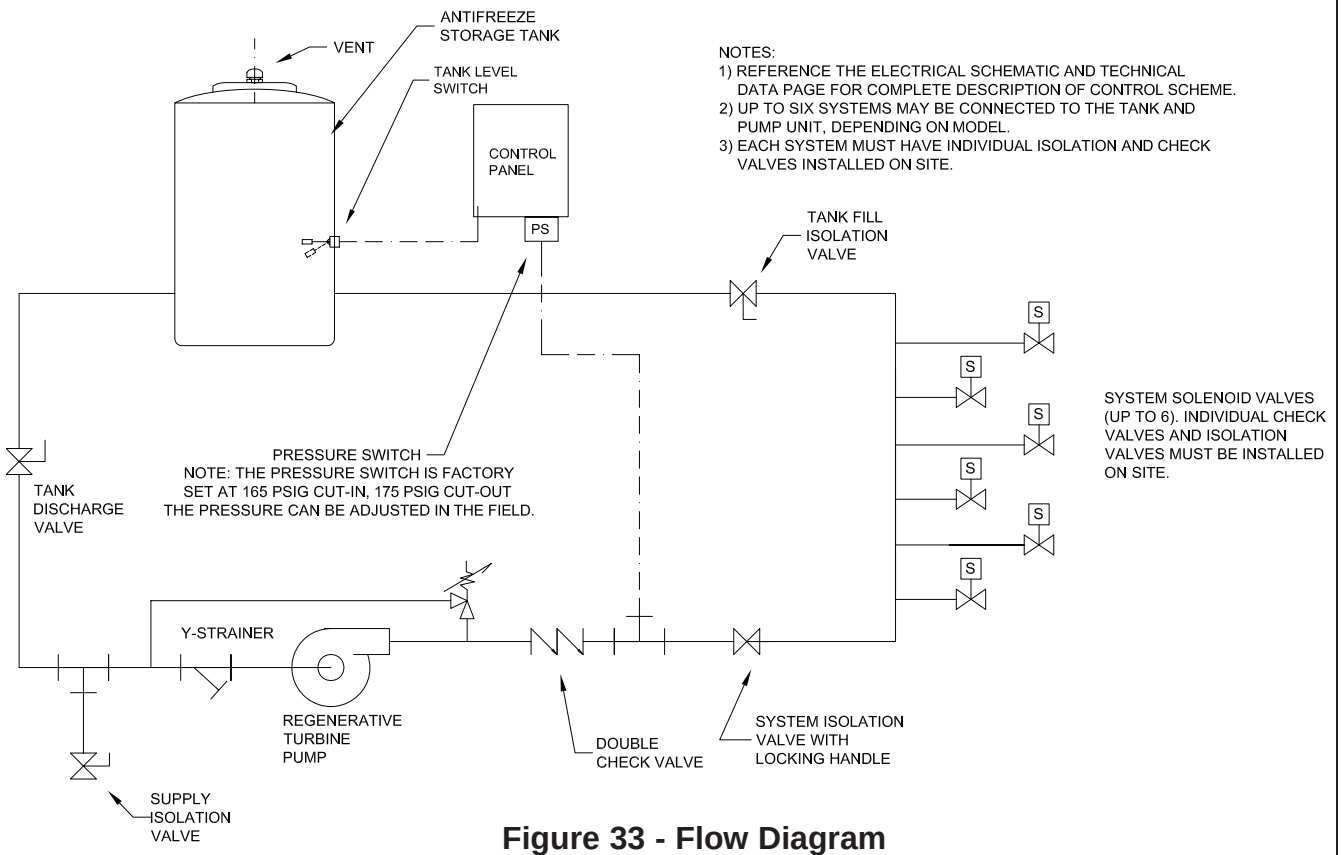

ANTIFREEZE STORAGE TANK
VENT
TANK LEVEL SWITCH
CONTROL PANEL
PS
NOTES:
1) REFERENCE THE ELECTRICAL SCHEMATIC AND TECHNICAL DATA PAGE FOR COMPLETE DESCRIPTION OF CONTROL SCHEME.
2) UP TO SIX SYSTEMS MAY BE CONNECTED TO THE TANK AND PUMP UNIT, DEPENDING ON MODEL.
3) EACH SYSTEM MUST HAVE INDIVIDUAL ISOLATION AND CHECK VALVES INSTALLED ON SITE.
TANK FILL ISOLATION VALVE
S
SYSTEM SOLENOID VALVES (UP TO 6). INDIVIDUAL CHECK VALVES AND ISOLATION VALVES MUST BE INSTALLED ON SITE.
PRESSURE SWITCH
NOTE: THE PRESSURE SWITCH IS FACTORY SET AT 165 PSIG CUT-IN, 175 PSIG CUT-OUT THE PRESSURE CAN BE ADJUSTED IN THE FIELD.
TANK DISCHARGE VALVE
Y-STRAINER
REGENERATIVE TURBINE PUMP
DOUBLE CHECK VALVE
SYSTEM ISOLATION VALVE WITH LOCKING HANDLE
SUPPLY ISOLATION VALVE

Figure 33 - Flow Diagram

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

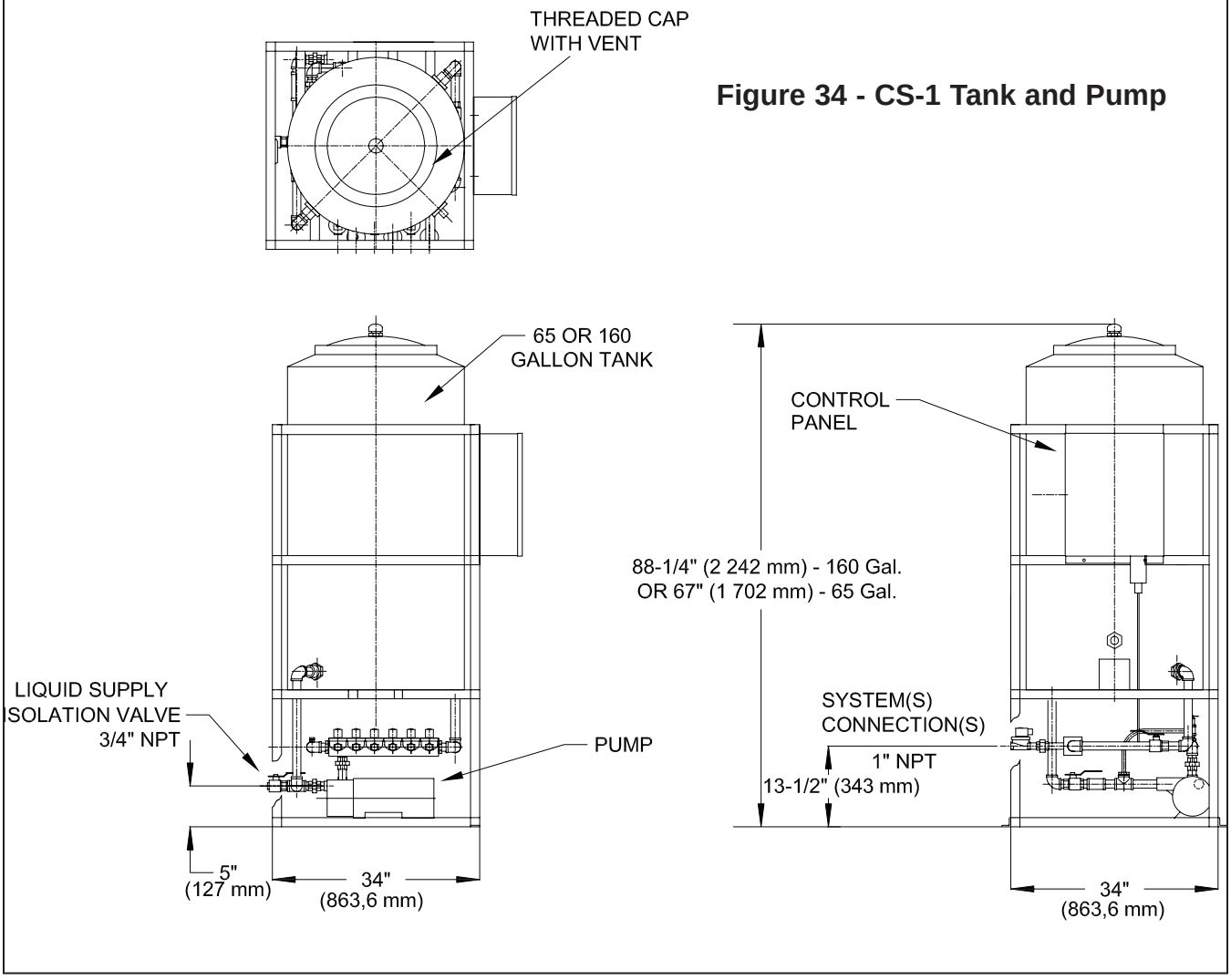


Figure 34 - CS-1 Tank and Pump

Table 8 - Recommended Spare Parts List

Description	Rec. Qty.	P/N	Description	Rec. Qty.	P/N
Pump Basic Repair Kit - Includes Seal Stationary Element, Seal Stationary Seat, Casing O-Ring, Impeller (Type "L")	1	13052	Overload Heater (Indicate Unit Voltage for Correct Selection)		
			208V-60 HZ-3 PH	3	13059
Level Switch, Stainless Steel Wetted Components, ½" NPT External Side Mounting, ½" NPT Conduit Connection	1	13054	230V-60 HZ-3 PH		13060
Solenoid Valve, ¾" Normally Closed 120V-60 HZ	1	12955	460V-60 HZ-3 PH		13061
Solenoid Valve, ¾" Normally Closed 110V-50 HZ	1	13194	575V-60 HZ-3 PH		13062
Ball Valve, 1"	1	13055	Control Relay	1	13063
Double Spring Check Valve, Brass	1	13056	Transformer Primary Fuse, ½ AMP	2	13064
Pressure Switch, Factory Set at 165 cut-in, 175 psig cut-out. Should be field adjusted.	1	13057	Transformer Secondary Fuse, 1 AMP	1	13065
Pressure Switch Cable	1	13231	Pilot Light, Green LED, 120V, NEMA 4X	1	13066
Magnetic Starter	1	13058			

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

Table 9 - CS-1 Schematic Drawing Numbers

	Drawing Number		Manual Page	
	60Hz	50Hz	60Hz	50Hz
Single Riser	13050-1	13051-1	60-61	72-73
Two Risers	13050-2	13051-2	62-63	74-75
Three Risers	13050-3	13051-3	64-65	76-77
Four Risers	13050-4	13051-4	66-67	78-79
Five Risers	13050-5	13051-5	68-69	80-81
Six Risers	13050-6	13051-6	70-71	82-83

Table 10 - Inputs and Outputs

Inputs		Outputs	
Input 1	"Manual" position of Hand-Off- Auto Switch	**Output 1**	"Power On" light
Input 2	"Auto" position of Hand-Off- Auto Switch	**Output 2**	Pump Motor Starter Coil and "Pump" light
Input 3	Pressure Switch of Pumping Unit	**Output 3**	System 1 Solenoid Valve
Input 4	Tank Level Switch	**Output 4**	System 2 Solenoid Valve
Input 5	System 1 Inputs	**Output 5**	System 3 Solenoid Valve
Input 6	System 2 Inputs	**Output 6**	System 4 Solenoid Valve
Input 7	System 3 Inputs	**Output 7**	System 5 Solenoid Valve
Input 8	System 4 Inputs	**Output 8**	System 6 Solenoid Valve
Input 9	System 5 Inputs	**Output 9**	Level Switch Relay Coil
Input 10	System 6 Inputs		
Input 11	Switch A – Down Position		
Input 12	Switch A – Up Position		
Input 13	Switch B – Down Position		
Input 14	Switch B – Up Position		

Table 11 - Control Logic

Output 1	"Power On" light	Output 1 on when: Input 1 or Input 2 are on.		
Output 2	Pump Motor Starter Coil and "Pump" light	Output 2 on when: (Manual Mode System and Tank Filling) Input 1 on + Input 3 on.	**-or-**	(Automatic Mode) Input 2 on + Input 3 on + Input 4 on + And Internal Timer times to 10 minutes. The timer begins when Manual or Automatic mode is started and is reset when pump turns off in Automatic Mode.
Output 3	System 1 Solenoid Valve	Output 3 on when: (Manual Mode) Input 1 on and Input 5 on and Input 12 on and Input 13 off and Input 14 off.	**-or-**	(Automatic Mode) Input 2 on and Input 5 on.
Output 4	System 2 Solenoid Valve	Output 4 on when: (Manual Mode) Input 1 on and Input 6 on and Input 11 on and Input 13 off and Input 14 off.	**-or-**	(Automatic Mode) Input 2 on and Input 6 on.
Output 5	System 3 Solenoid Valve	Output 5 on when: (Manual Mode) Input 1 on and Input 7 on and Input 11 off and Input 12 off and Input 14 on.	**-or-**	(Automatic Mode) Input 2 on and Input 7 on.
Output 6	System 4 Solenoid Valve	Output 6 on when: (Manual Mode) Input 1 on and Input 8 on and Input 11 off and Input 12 off and Input 13 on.	**-or-**	(Automatic Mode) Input 2 on and Input 8 on.
Output 7	System 5 Solenoid Valve	Output 7 on when: (Manual Mode) Input 1 on and Input 9 on and Input 12 on and Input 14 on.	**-or-**	(Automatic Mode) Input 2 on and Input 9 on.
Output 8	System 6 Solenoid Valve	Output 8 on when: (Manual Mode) Input 1 on and Input 10 on and Input 11 on and Input 13 on.	**-or-**	(Automatic Mode) Input 2 on and Input 10 on.
Output 9	Level Switch Relay Coil	Output 9 on when: Input 4 on.		

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

D. CS-1 Control Scheme

1. Pump Operation

The pressure switch mounted on the CS-1 controls pump operation. When the pressure at the CS-1 drops, the pump will turn on until the pressure at the CS-1 rises above a set level. In “Automatic” mode, pump operation is inhibited if the level of liquid in the unit’s storage tank drops below the level switch height.

In “Manual” mode, the pump operates when CS-1 pressure drops, a system valve is selected, if that system pressure is not met, and there is no alarm condition. The pump can also fill the tank in Manual mode. For tank filling, the level switch position is not used and the operator must start and stop the pump, using the “Man” position of the Man-Off-Auto Switch on the control panel.

In Automatic mode, there is a 10-minute time delay between pump operations. After the 10-minute delay, the pump operates if the CS-1 pressure drops and tank fluid level is above the level switch height. When the pump shuts off, the 10-minute timer starts again and the pump will not operate until 10 minutes is complete.

2. System Solenoid Valve Operation

Each system (riser) pressure switch and alarm pressure switch contacts are connected in series to one input on the PLC. The system pressure switch opens on falling pressure. The alarm pressure switch normally closed contacts are used and open in the alarm condition.

In Automatic mode, each system solenoid valve opens if its system pressure drops to a low-pressure condition and there is no alarm pressure signal. In manual mode, each system valve is selected by means of two selector switches and the solenoid valve opens as long as system pressure is below the set-point value and there is no system alarm.* Note: To operate in manual mode, all switches must be wired.

3. Level Switch Relay Coil Operation

The level switch relay coil is energized when the tank level is above the level switch height. This is when tank level is satisfied. The switch relay coil de-energizes when tank level drops to the level switch height, at low tank level.

E. Filling the Reservoir Tank

The CS-1 has been designed to fill the reservoir tank using either of two methods: gravity fill or pumped fill. NOTE: This is NOT a self-priming pump. Manually prime or fill the reservoir for prime.

***NOTE: Never leave the unit unattended when filling the system or tank. Running the pump dry, without liquid, will damage pump seals and possibly damage pump impeller.**

Follow the steps below:

1. Gravity Fill:

1. Turn off and isolate the electrical supply to the unit.
2. Close Supply Isolation valve.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

3. Connect the antifreeze supply container to the supply isolation valve. A flexible hose may be used, but must not restrict the flow from the supply container to the valve. An additional isolation valve must be installed in the line between the supply container and unit's supply isolation valve.
4. Open the shut off valve on the supply container and supply isolation valve on the CS-1.
5. Open the pump suction isolation valve and allow liquid to enter the reservoir tank. If there is enough liquid in the supply container, the tank may be filled completely using this method. The tank is full when the liquid level rises to the top of the straight section of the tank.

2. Pump Assist Fill:

If there is not sufficient liquid in the supply container to fill the tank or the tank fills too slowly, the pump on the CS-1 may be manually operated to speed up this process. Follow steps 1 to 4 above and 2 to 5 below to fill the storage tank using the pump. A slight downward slope from the supply container to the valve connection is required to prime the pump and maintain positive head on the pump inlet. Always use a backup wrench when making piping connections to avoid damage to the unit's piping.

1. Close the tank discharge isolation valve and open the tank fill isolation valve.
2. With the CS-1 "OFF-ON" switch in the "OFF" position, turn on power supply to the unit.
3. Position switches "A" and "B" in the center/off position. Switch the "Man-O-AUTO" switch on the unit control panel to "Man" and the "OFF-ON" switch to "ON". Liquid will begin to fill the storage tank at the fill connection.
4. Be careful to observe the liquid level to prevent overfilling. When the liquid level reaches the top of the straight section of tank, switch the unit's "Man-O-AUTO" switch to "O".
5. Close the liquid supply isolation and tank fill isolation valves. Open the tank discharge isolation valve.

F. Filling Systems

A suitable portable pump can be utilized to fill the system. (The CS-1 pump can be used for filling the system initially at 15 GPM (56 l/min) to 100 ft head pressure or system static pressure. However, it is a less efficient pump for filling the system because of the duration of time required to do so. To fill the system, the system solenoid on the CS-1 is connected to the liquid supply isolation valve of the Easy Riser® Check Valve for that system. All pressure switches must be installed and set. The system to be filled is selected using two toggle switches on the CS-1 control enclosure. Antifreeze from the supply is pumped to the system piping. Pump operation is manually controlled during the fill process. The CS-1 pump is to be utilized to bring the solution to maintenance pressure, and is designed to maintain system pressure once the system is initially filled. Appropriate vent/bleed valves must be installed on each system's piping at all local high points to allow air to escape while liquid fills the system.

NOTE: Never leave the unit unattended when filling the system. Running the pump dry, without liquid, will damage pump seals and possibly damage the pump impeller.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

Table 12 - Input Descriptions

Input	Description
1	"Man" position of Hand-Off- Auto Switch
2	"Auto" position of Hand-Off- Auto Switch
3	Pressure Switch of Pumping Unit
4	Tank Level Switch
5	System 1 Inputs
6	System 2 Inputs
7	System 3 Inputs
8	System 4 Inputs
9	System 5 Inputs
10	System 6 Inputs
11	Switch A – Down Position
12	Switch A – Up Position
13	Switch B – Down Position
14	Switch B – Up Position

Table 13 - Output Descriptions

Output	Description	Control Logic
1	"Power On" light	Output 1 on when: Input 1 or Input 2 are on.
2	Pump Motor Starter Coil and "Pump" light	Output 2 on when: **(Manual Mode System and Tank Filling)** Input 1 on + Input 3 on. **OR** **(Automatic Mode)** Input 2 on + Input 3 on + Input 4 on and Internal Timer times to 10 minutes. The timer begins when Manual or Automatic mode is started and is reset when pump turns off in Automatic Mode.
3	System 1 Solenoid Valve	Output 3 on when: **(Manual Mode)** Input 1 on and Input 5 on and Input 12 on and Input 13 off and Input 14 off. **OR** **(Automatic Mode)** Input 2 on and Input 5 on.
4	System 2 Solenoid Valve	Output 4 on when: **(Manual Mode)** Input 1 on and Input 6 on and Input 11 on and Input 13 off and Input 14 off. **OR** **(Automatic Mode)** Input 2 on and Input 6 on.
5	System 3 Solenoid Valve	Output 5 on when: **(Manual Mode)** Input 1 on and Input 7 on and Input 11 off and Input 12 off and Input 14 on. **OR** **(Automatic Mode)** Input 2 on and Input 7 on.
6	System 4 Solenoid Valve	Output 6 on when: **(Manual Mode)** Input 1 on and Input 8 on and Input 11 off and Input 12 off and Input 13 on. **OR** **(Automatic Mode)** Input 2 on and Input 8 on.
7	System 5 Solenoid Valve	Output 7 on when: **(Manual Mode)** Input 1 on and Input 9 on and Input 12 on and Input 14 on. **OR** **(Automatic Mode)** Input 2 on and Input 9 on.
8	System 6 Solenoid Valve	Output 8 on when: **(Manual Mode)** Input 1 on and Input 10 on and Input 11 on and Input 13 on. **OR** **(Automatic Mode)** Input 2 on and Input 10 on.
9	Level Switch Relay Coil	Output 9 on when: Input 4 on.

Follow the steps below:

1. Turn off and isolate the electrical supply to the unit.
2. Close the liquid supply valve and Tank Fill isolation valves.
3. If not already connected to fill the storage tank, connect the antifreeze supply container to the liquid supply valve. A flexible hose may be used, but must not restrict the flow from the supply container to the valve. An additional isolation valve must be installed in the line between the supply container and unit's liquid supply valve. A slight downward slope from the supply container to the unit's valve connection is required to prime the pump and maintain positive head on pump inlet. Always use a backup wrench when making piping connections to avoid damage to the unit's piping.
4. Open the shut-off valve on the supply container and liquid supply valve on the CS-1.
5. Open high-point vent/bleed valves on the system.
6. Select system to be filled using switches "A" and "B". Use Table 14 or the table on the CS-1 Panel to determine switch "A" and "B" position.
7. With the CS-1's "OFF-ON" switch in the "OFF" position, turn on the power supply to the unit.
8. Switch the "Man-O-AUTO" switch on the unit control panel to "Man". Turn the "Off-On" switch to "ON". Liquid will begin to fill the selected system.
9. As the system fills, monitor the system vent/bleed valves. Close each valve when liquid leaks from it.
10. When the liquid leaks from the uppermost vent/bleed valve, close the vent valve. The system pressure switch will close that system's solenoid valve when set pressure is established. The pump pressure switch will turn the pump off when set pressure is established.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

11. If another system is to be filled, turn the “Man-O-AUTO” switch to “O” and select the next system using switches A and B.
12. Turn the “Man-O-AUTO” switch to “Man” and repeat steps 8 through 10.
13. After filling all systems and the CS-1 tank, close the liquid supply valve.
14. All air must be out of the system before switching the unit to maintenance mode. Follow the system manufacturer’s recommendations to ensure all air is removed.

G. Operating in Maintenance Mode: Automatic

As previously stated, the CS-1 is designed to maintain the antifreeze pressure in the sprinkler system at a supervisory pressure of 50 PSI (3.4 Bar). A pressure switch installed in the pump discharge line operates the pump between two pressures sensed in the unit’s piping. A pressure switch on each system sends a signal to the CS-1 to open and close that system’s solenoid valve.

Ensure all air is removed from system piping before placing the unit in automatic operation.

Liquid level in the storage tank must be above the level switch height or pump operation is inhibited.

Close the liquid supply and tank fill isolation valves. Open the tank discharge isolation valve and system liquid supply isolation valve.

With the “ON-OFF” switch “ON”, switch the “Man-O-AUTO” switch to the “AUTO” position. The CS-1 is now operating in Maintenance mode.

NOTE: The CS-1 control system uses a time delay relay, set at 10 minutes, to limit pump operation to six times per hour maximum. When the unit is first energized in “AUTO”, pump operation is delayed for 10 minutes.

After 10 minutes, if the CS-1 piping is below the unit’s pressure switch setting, the pump motor will operate, raising CS-1 manifold pressure.

The pump will turn off at the pressure switch cutout pressure.

Each system’s solenoid valve will open in response to system pressure switch.

Table 14 - Switch Settings

System Selected	Switch A Position	Switch B Position
No System - Tank Fill	Centered	Centered
System 1	Up	Centered
System 2	Down	Centered
System 3	Centered	Up
System 4	Centered	Down
System 5	Up	Up
System 6	Down	Down

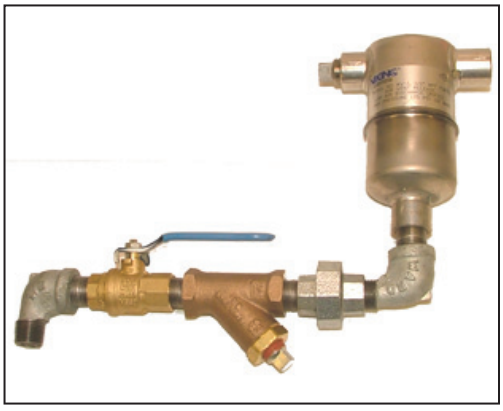
The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

H. Inspections, Tests and Maintenance

Table 15 - Troubleshooting Guide

Problem	Possible Causes	Remedies
Unit will not turn on.	1) Power disconnected. 2) Blown fuse.	1) Check power at supply and unit, and correct. 2) Check fuses, replace as required, and determine cause of blown fuse.
Pump does not operate in Automatic mode when CS-1 pressure drops.	1) No power to unit. 2) Liquid level in tank low. 3) Magnetic starter overload tripped. 4) Time delay active. 5) Pump motor defective.	1) Verify power at unit terminal block. 2) Fill tank to proper height. 3) Verify and fix cause of overload. Press reset button on starter. 4) Wait 10 minutes for time delay to time out. Correct leaks in system. 5) Replace.
Pump does not operate in Automatic mode when system valve opens.	1) Pump operates on manifold pressure, not system pressure. System pressure switch setting is higher than the CS-1 pressure switch setting.	1) Verify system pressure switch setting is correct. The CS-1 pressure switch setting must not be adjusted higher. Adjust CS-1 switch setting lower if approved by factory.
Failure to pump.	1) Supply container empty. 2) Incorrect valve position. 3) Pump rotation backward. 4) Insufficient head pressure to pump inlet. 5) Pump not up to speed. 6) Clogged suction line. 7) Air in suction line.	1) Connect full supply container. 2) Correct valve position per instructions. 3) Correct pump rotation. 4) Raise supply container. 5) Check voltage. 6) Inspect and clean Y-Strainer. 7) Check for air in pump suction line.
Excessive power consumption.	1) Pump not fully broken in. 2) Mechanical damage.	1) Pump normally draws higher current during break-in period. This condition will work itself out after several weeks. 2) Turn pump over by hand. If there are tight spots after break-in, call Technical Services.
Other pump-related problems.	If other pump related problems are suspected, call the Viking Technical Services Department at 1-877-384-5464.	
Pump stops before desired system pressure.	Discharge pipe is too small or there is a buildup of back pressure.	1) Increase pipe size. 2) Increase dS1 setting on pump switch. 3) Make sure dr1 setting is set to 0.50.

11. Air / Vacuum Vent



The Viking AV-1 device is a float operated automatic air vent that is installed at high points of the sprinkler system where air pockets can accumulate. As the system fills, air is automatically vented through the orifice of the vent valve. When the system is full, the water or antifreeze solution raises the float due to buoyancy and shuts off the outlet orifice. As air throughout the system accumulates at the high points of system piping, it will be automatically expelled to provide air-free system piping.

Airflow during venting is restricted due to differential pressure across vent orifice. It is recommended to slow fill the system initially to minimize the buildup of air in the system. See Table 16 for air flow capacity at various differential pressures.

Having the AV-1 installed on the end of each high-point branch line and/or main provides quicker and more complete drainage of system piping. This is because during drainage of system piping, the AV-1 will open and allow air to enter and break the vacuum inside the piping.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

A. Installation

The AV-1 shall be installed at all high points of the ESFR Cold Storage piping, including branch lines and main feed lines.

In order to install the AV-1 assembly in the space from the ceiling to the sprinkler, the isolation ball valve and strainer must be installed in the horizontal position as illustrated in Figure 2 and the AV-1 must be installed with the (2) outlet connections at the top location. This position is critical in order to allow the float within the device to operate properly.

The outlet connection needs to be piped using 3/8" (9.5 mm) outside diameter plastic or copper tubing unrestricted downward and away from protected product below. This is due to possible small amounts of moisture that could spurt out during venting of the system. Copper is recommended in order to function during and after fire situations and long-lasting durability. Attach to the ½" NPT vent connection as shown in Figure 32.

B. Ordering Information

Model AV-1 Valve and Trim Kit: Part Number 13495
Model AV-1 Vent Valve Only: Part Number 13494

C. Inspections, Tests and Maintenance

1. The top inlet connection can be used as a sampling discharge connection that can be piped to a floor level location, or attach a manual bleed valve to take sample antifreeze from desired locations. If this connection is not being used, then it must be plugged with the pipe plug furnished with product.
2. Regular inspection for leakage from the discharge outlet and plugging of the strainer is recomended. By shutting off the isolation valve, open strainer screen plug, drain liquid from the assembly, the float should open. Check the strainer for debris, clean. and re-assemble. Open the isolation valve slowly and make sure the AV-1 vents and shuts off when filling with liquid. Opening the isolation valve slowly will prevent the alarm system from operating due to fast liquid flow past the sprinkler system alarm valve.
3. When using the outlet connection as a sample point for the antifreeze system, allow to flow long enough to obtain solution sample from the branch pipe area and not from the drop leg of the sample tube.
4. It is normal on hydronic systems to have no discharge from the auto vent valves.
5. During routine maintenance of the unit, observe air flow from the vent during recharge of the AV-1. During proper operation, air will flow from outlet followed by a small amount of liquid, then shut off.
6. If debris is collected on the seat, liquid leakage will occur. Isolate with the ball valve. Remove the AV-1 and back flush using clean water through the outlet vent connection to flush out scale and debris. Re-check operation before reinstallation. If there is still improper function, replacement of the AV-1 valve is required.

Table 16 - Discharge of Air Through an Orifice at Standard Atmospheric Pressure of 14.7 PSI and 70 °F

Pressure Psi (bar)	5 (0.34)	20 (1.38)	40 (2.76)	50 (3.45)	60 (4.14)	70 (4.83)	80 (5.52)	90 (6.21)	100 (6.90)	110 (7.59)	125 (8.62)	150 (10.34)	175 (12.07)
Air flow SCFM (L/sec)	2.58 (1.22)	4.99 (2.36)	7.71 (3.64)	9.24 (4.36)	10.80 (5.10)	12.30 (5.81)	13.80 (6.51)	15.30 (7.22)	16.70 (7.88)	18.20 (8.59)	20.50 (9.68)	24.20 (11.42)	27.90 (13.17)

$$\text{SCFM} = (\text{CFM or ACFM}) \times \frac{(14.7+p)}{14.7} \times \frac{520}{(460+t)}$$

Where: p = gauge pressure of gas or vapor (psig)

t = temperature of gas or vapor (°F)

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

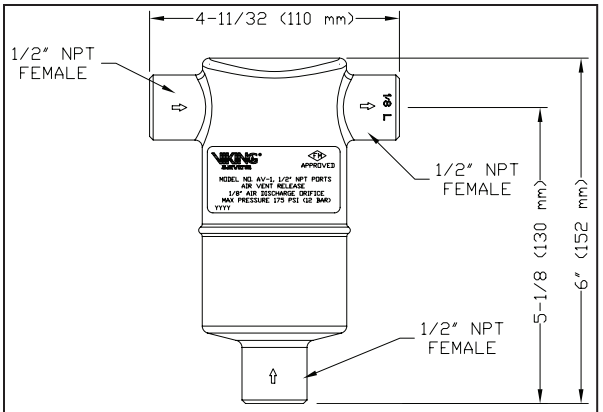


Figure 35 - Av-1 Dimensions

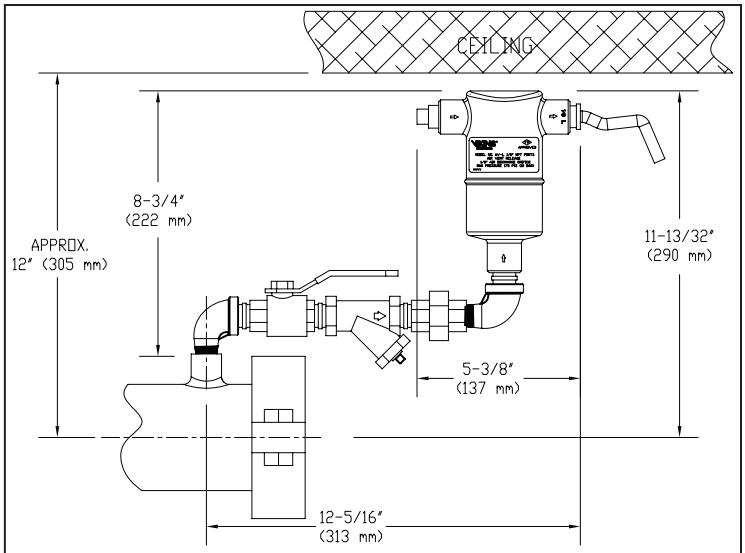
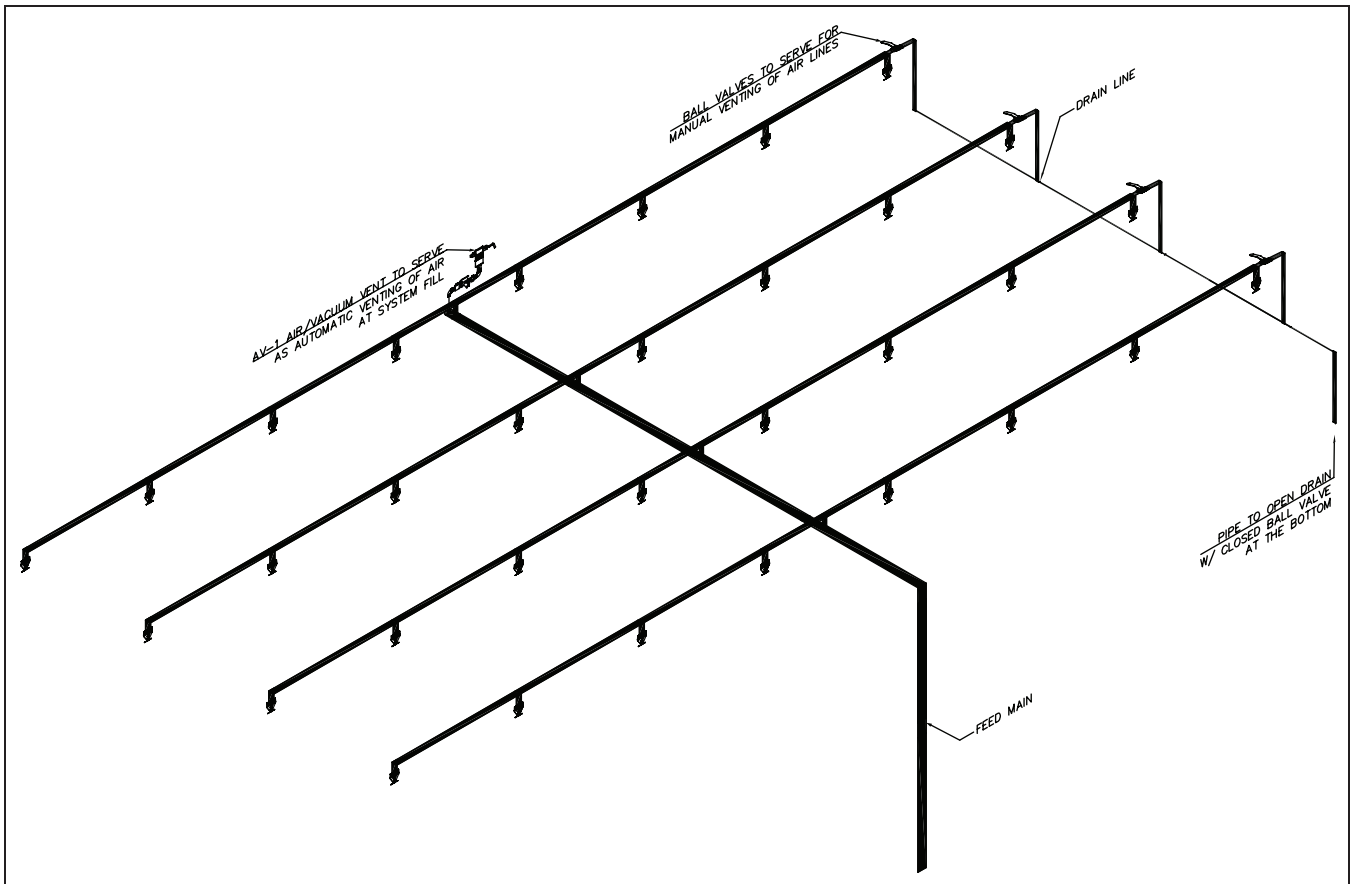


Figure 36 - Av-1 on Branch Line Pipe


BALL VALVES TO SERVE FOR MANUAL VENTING OF AIR LINES
DRAIN LINE
AV-1 AIR/VACUUM VENT TO SERVE AS AUTOMATIC VENTING OF AIR AT SYSTEM FILL
PIPE TO OPEN DRAIN W/ CLOSED BALL VALVE AT THE BOTTOM
FEED MAIN

Automatic air vents or ½" manual bleed valves must be installed at the highest and most remote points of the system in order to completely vent out all air during the propylene glycol filling process. Additional vents or ½" bleed valves shall be installed on the end of branch lines at high points. The manual bleed valves may also be used for antifreeze testing sample points.

Figure 37 - Recommended Arrangement of AV-1 and Branch Line Drains

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

12. Firefighter Eliminator

A. Description

Viking Firefighter Eliminator C and F is a certified premixed propylene glycol/water antifreeze solution required for use with the Viking ESFR Cold Storage System.

B. Technical Data

Table 17 - Typical Properties (Not for specification purposes)

	Concentration	Part Numbers	Minimum use Temperature	Freeze Point	pH	Apperance
Firefighter C	35% by volume propylene glycol < 5% dipotassium phosphate < 3% coloring	12968-55 = 55 gallon drum 12968-275 = 275 gallon drum 12968-BULK = tanker delivery	8 °F (-13.3 °C)	2.4°F (-16.4 °C)	9	Fluorescent green color
Firefighter F	50% by volume propylene glycol < 5% dipotassium phosphate < 3% coloring	12967-55 = 55 gallon drum 12967-275 = 275 gallon drum 12967-BULK = tanker delivery	-21 °F (-29.4 °C)	-26 °F (-32.2 °C)	9	Fluorescent orange color
For further details, see the Viking Firefighter Eliminator C Material Safety Data Sheet (pages 49e-g and 50e-g).						
Environmental & Toxicological Information: Viking Firefighter Eliminator is virtually harmless to animals or plants; however, as with any substance, care should be taken to prevent discharge from entering ground water, surface water, or storm drains. Disposal of this solution should be made in accordance with federal, state, and local regulations.						
Propylene glycol/water solutions are designed to be installed on systems supplied by potable water supplies. Local authorities should be consulted prior to draining system to storm sewers or to natural drainage areas.						
Manufactured by: The Noble Company, 7300 Enterprise Dr., Spring Lake, MI U.S.A. 49456						

C. Inspections, Tests and Maintenance

Field mixing of propylene glycol and site water is strictly prohibited, as the control of the mixture cannot be assured. Improper field mixing of solution can result in reduced capability to prevent freezing or to control a fire. Firefighter Eliminator is already premixed and ready to use.

Testing the Solution:

Antifreeze solution shall be checked semi-annually with a refractometer to detect the concentration of antifreeze solution and effectiveness against freezing. Sampling shall be taken from multiple points within the freezer system (refer to the instructions on data page 45d for fluid sampling). When draining sample antifreeze solution from the system, be sure to shut off the system control valve directly upstream of the Easy Riser® Check valve so that water doesn't enter the system.

Table 18 - Solution Properties for Given Temperatures

Solution	Temperature	Specific Gravity	Density (lbs/ft³)	Viscosity (cps)
Firefighter 35% Eliminator C	6 °F (-14.5 °C)	1.040	64.90	18
	68 °F (20 °C)	1.033	64.46	4
Firefighter 50% Eliminator F	-20° F (-28.9 °C)	1.085	67.70	180
	-10 °F (-23.3 °C)	1.061	66.20	96
	0 °F (-17.8 °C)	1.056	65.89	61
	60 °F (15.6 °C)	1.041	64.96	8.13

Table 19 - Propylene Glycol Refractive Index

Solution	Freezing Point	Volume % Propylene Glycol	Refractive Index 71.6 °F (22 °C)
Firefighter 50% Eliminator F	25.8 °F (-32.1 °C)	48.9%	1.3892
	28.3 °F (-33.5 °C)	49.9%	1.3903
	-31 °F (-35.0 °C)	50.9%	1.3914
Firefighter 35% Eliminator C	2.5 °F (-16.4 °C)	34.4%	1.3733
	.9 °F (-17.3 °C)	35.5%	1.3744
	-.8 °F (.18.2 °C)	36.5%	1.3756

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

After the CS-1 pump has restored the antifreeze solution pressure, ensure that the water supply control valve is returned to the fully open position once fluid sampling is completed. Multiple propylene glycol/water solution test valves (refer to Figure 37) are to be installed in several areas on the system piping for testing with a refractometer (refer to data page 45a-j for testing requirements and procedures).

IV. WIRING

The Electrical wiring is broken down into 4 Circuits as shown in Figure 38.

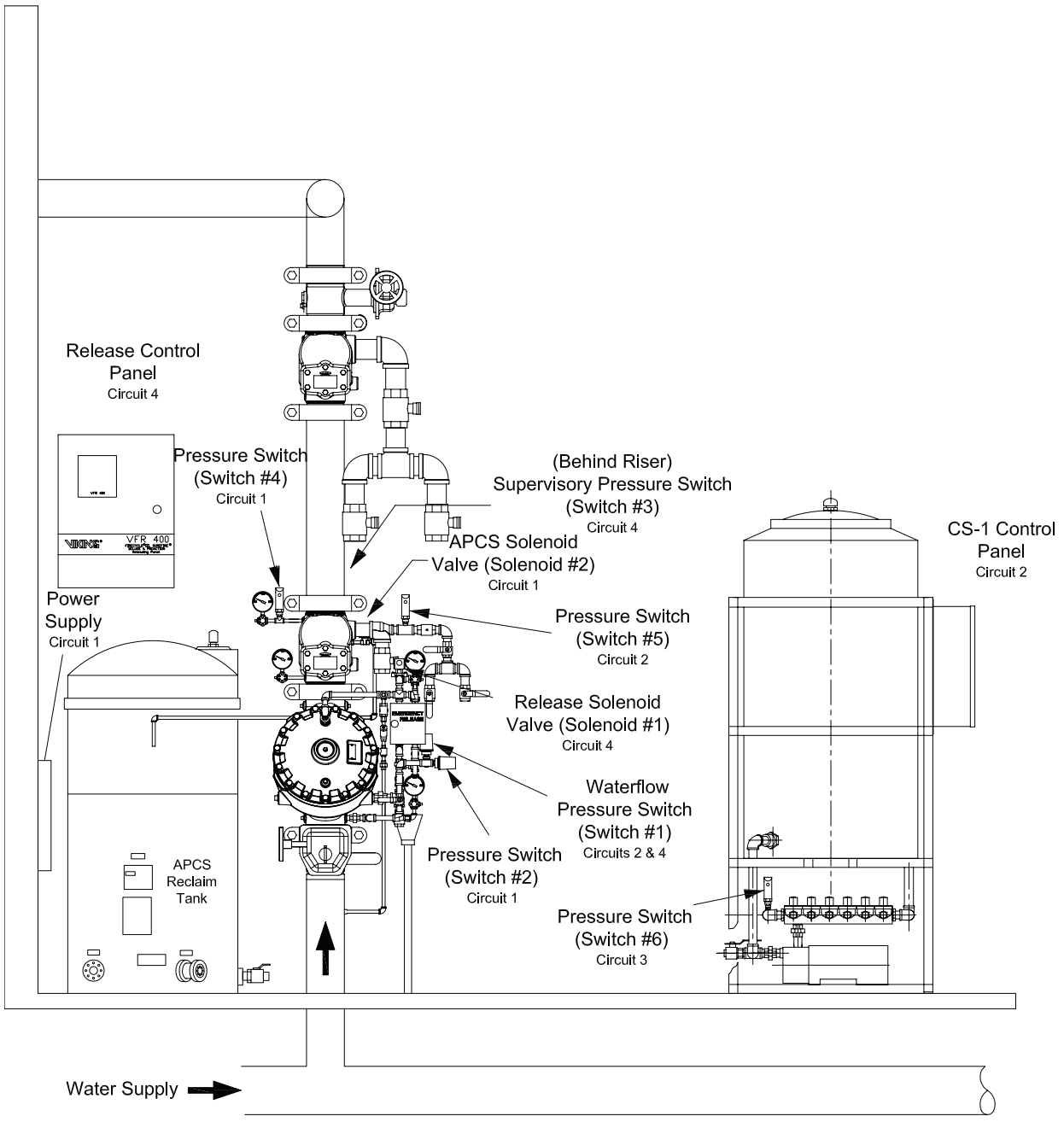
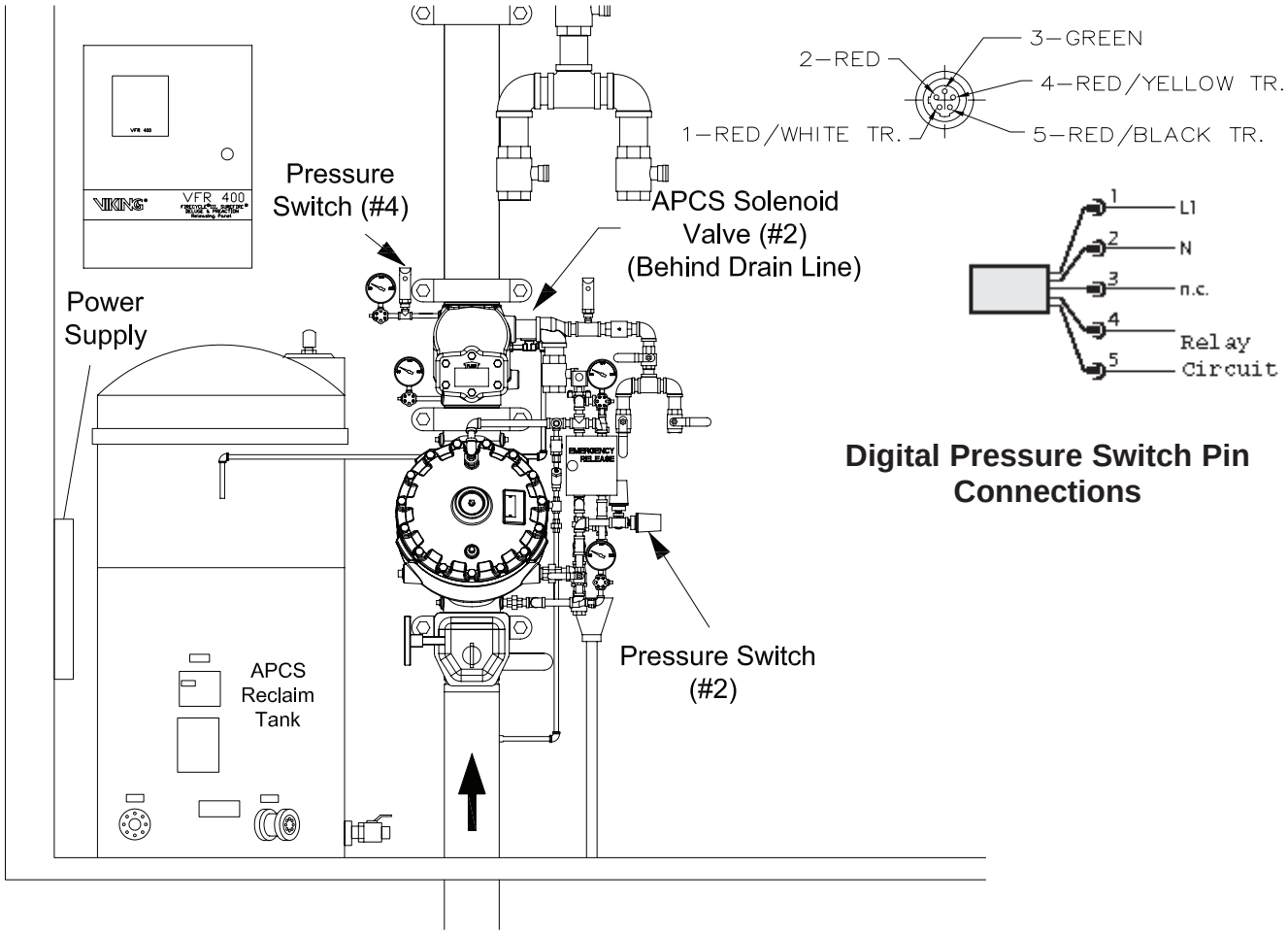


Figure 38 - Wiring Circuits

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

1. Wiring Circuit 1

Wiring circuit 1 is described in Section IV.5.A - Cold Storage Trim with Automatic Pressure Control System.



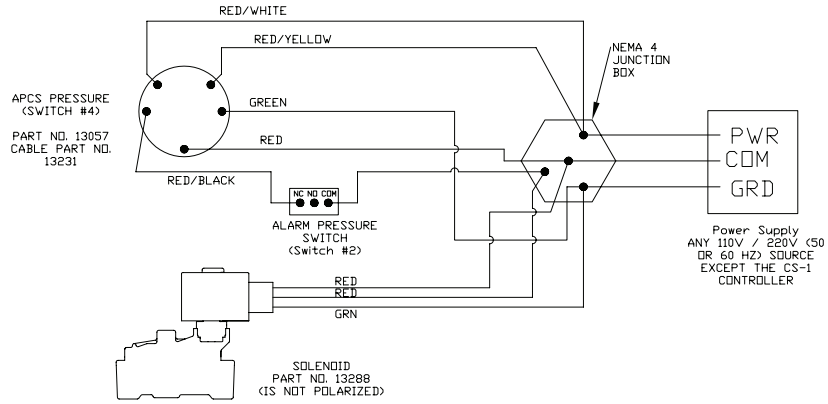


Figure 39 - Circuit 1

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

2. Wiring Cicuit 2

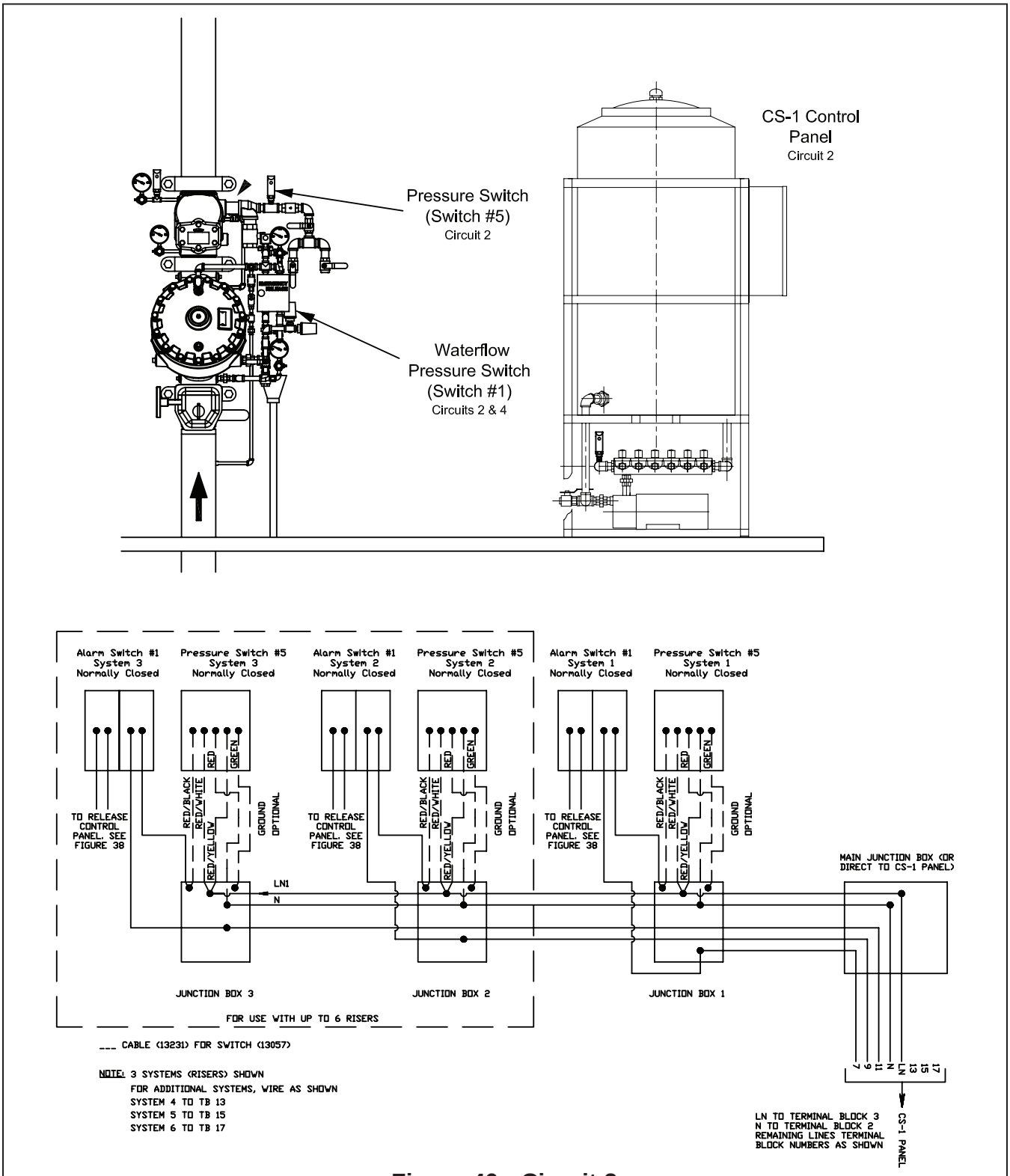

CS-1 Control Panel
Circuit 2
Pressure Switch (Switch #5)
Circuit 2
Waterflow Pressure Switch (Switch #1)
Circuits 2 & 4
Alarm Switch #1 System 3 Normally Closed
Pressure Switch #5 System 3 Normally Closed
Alarm Switch #1 System 2 Normally Closed
Pressure Switch #5 System 2 Normally Closed
Alarm Switch #1 System 1 Normally Closed
Pressure Switch #5 System 1 Normally Closed
RED
GREEN
RED/BLACK
RED/WHITE
RED/YELLOW
GROUND OPTIONAL
TO RELEASE CONTROL PANEL. SEE FIGURE 38
LN1
N
MAIN JUNCTION BOX (OR DIRECT TO CS-1 PANEL)
JUNCTION BOX 3
JUNCTION BOX 2
JUNCTION BOX 1
FOR USE WITH UP TO 6 RISERS
--- CABLE (13231) FOR SWITCH (13057)
NOTE: 3 SYSTEMS (RISERS) SHOWN
FOR ADDITIONAL SYSTEMS, WIRE AS SHOWN
SYSTEM 4 TO TB 13
SYSTEM 5 TO TB 15
SYSTEM 6 TO TB 17
7 9 11 N LN 13 15 17
LN TO TERMINAL BLOCK 3
N TO TERMINAL BLOCK 2
REMAINING LINES TERMINAL BLOCK NUMBERS AS SHOWN
CS-1 PANEL

Figure 40 - Circuit 2

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

3. Wiring Circuit 3

Wiring Circuit 3 is comprised of the CS-1 solenoid valve(s) and the CS-1 pressure switch. There are 12 wiring diagrams in the following pages, one for each model CS-1 Tank and Pump Package.

Table 20 - CS-1 Schematic Drawing Numbers

	Drawing Number		Manual Page	
	60Hz	50Hz	60Hz	50Hz
Single Riser	13050-1	13051-1	60-61	72-73
Two Risers	13050-2	13051-2	62-63	74-75
Three Risers	13050-3	13051-3	64-65	76-77
Four Risers	13050-4	13051-4	66-67	78-79
Five Risers	13050-5	13051-5	68-69	80-81
Six Risers	13050-6	13051-6	70-71	82-83

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

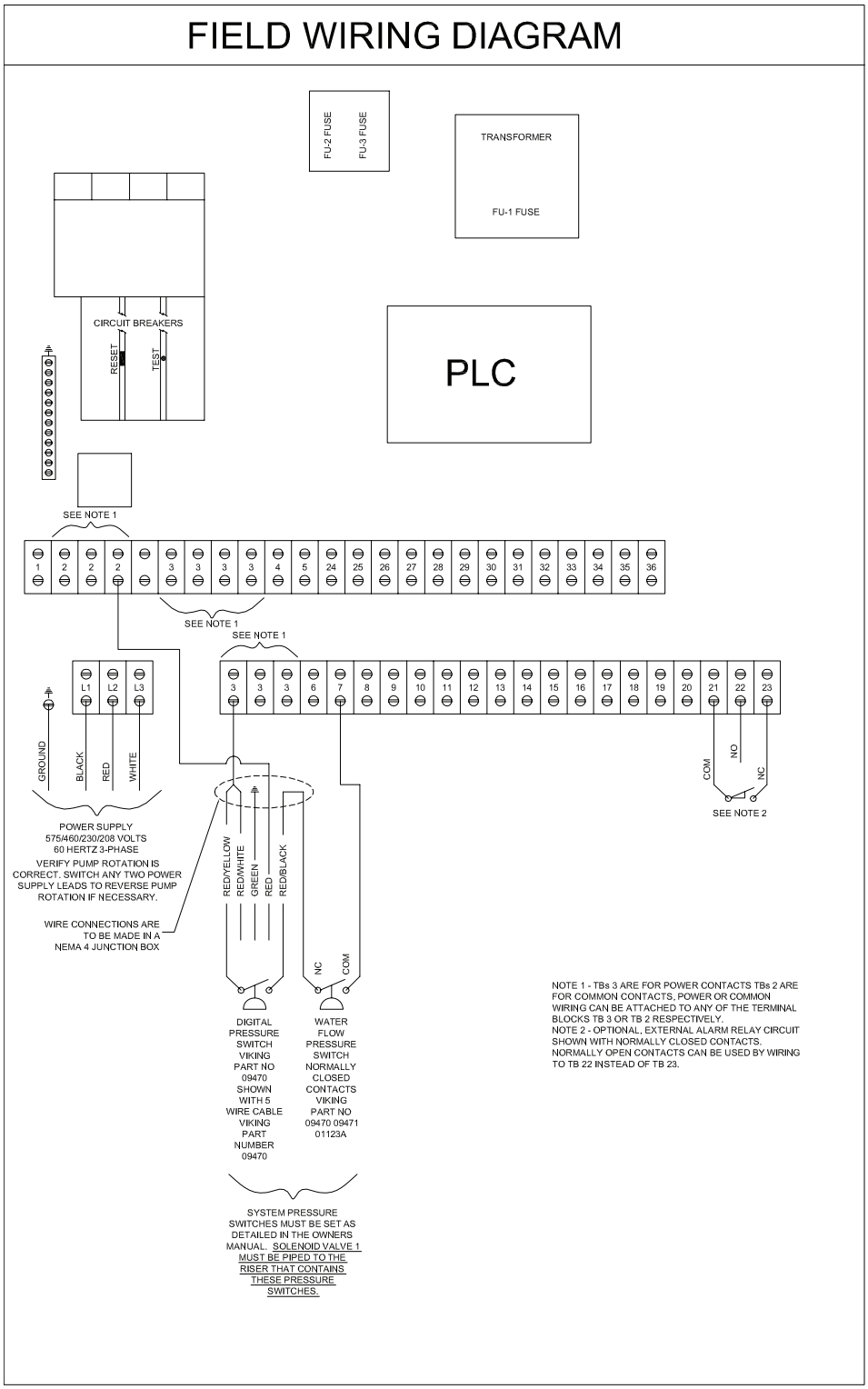
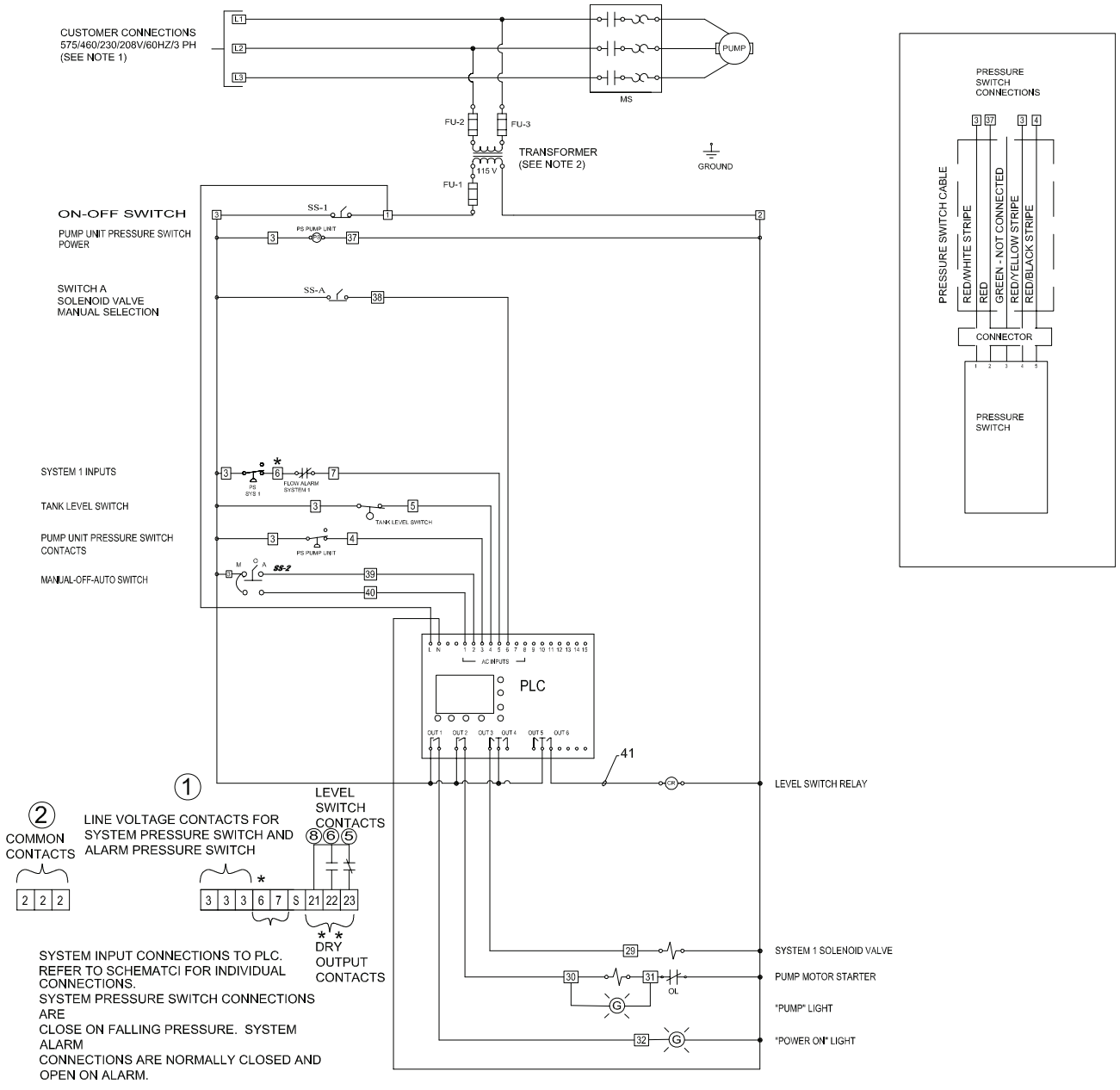

FIELD WIRING DIAGRAM
FU-2 FUSE
FU-3 FUSE
TRANSFORMER
FU-1 FUSE
CIRCUIT BREAKERS
RESET
TEST
PLC
SEE NOTE 1
SEE NOTE 1
SEE NOTE 1
L1
L2
L3
GROUND
BLACK
RED
WHITE
POWER SUPPLY
575/460/230/208 VOLTS
60 HERTZ 3-PHASE
VERIFY PUMP ROTATION IS CORRECT. SWITCH ANY TWO POWER SUPPLY LEADS TO REVERSE PUMP ROTATION IF NECESSARY.
WIRE CONNECTIONS ARE TO BE MADE IN A NEMA 4 JUNCTION BOX
RED/YELLOW
RED/WHITE
GREEN
RED
RED/BLACK
NC
COM
COM
NO
NC
SEE NOTE 2
DIGITAL PRESSURE SWITCH VIKING PART NO 09470 SHOWN WITH 5 WIRE CABLE VIKING PART NUMBER 09470
WATER FLOW PRESSURE SWITCH NORMALLY CLOSED CONTACTS VIKING PART NO 09470 09471 01123A
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 1 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
NOTE 1 - TBs 3 ARE FOR POWER CONTACTS TBs 2 ARE FOR COMMON CONTACTS, POWER OR COMMON WIRING CAN BE ATTACHED TO ANY OF THE TERMINAL BLOCKS TB 3 OR TB 2 RESPECTIVELY.
NOTE 2 - OPTIONAL, EXTERNAL ALARM RELAY CIRCUIT SHOWN WITH NORMALLY CLOSED CONTACTS. NORMALLY OPEN CONTACTS CAN BE USED BY WIRING TO TB 22 INSTEAD OF TB 23.

Figure 41a - Wiring Diagram 13050-1
60 Hz - 1 Solenoid

TECHNICAL DATA

ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



② * TERMINAL BLOCK 6 CAN BE USED TO CONNECT THE SYSTEM PRESSURE SWITCH TO THE ALARM PRESSURE SWITCH. ALTERNATIVELY, THIS CONNECTION CAN BE MADE IN A NEMA 4 JUNCTION BOX IF DESIRED. SEE SECTION 8.2 OF THE OWNERS MANUAL FOR WIRING DIAGRAM.

** A LOW FLUID LEVEL VISUAL OR AUDIBLE INDICATOR CAN BE FIELD SPECIFIED AND INSTALLED. TERMINAL BLOCK 21 IS THE COMMON CONTACT, TERMINAL 22 IS CONNECTED TO THE NORMALLY OPEN CIRCUIT OF THE LEVEL SWITCH, AND TERMINAL BLOCK 23 IS CONNECTED TO THE NORMALLY CLOSED CIRCUIT OF THE LEVEL SWITCH.

NOTES:
1) INPUT VOLTAGE IS CONNECTED TO TERMINALS L1, L2 AND L3.
2) TRANSFORMER CONNECTIONS ARE DETERMINED BY SUPPLY VOLTAGE.

Figure 41b - Wiring Diagram 13050-1
60 Hz - 1 Solenoid

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

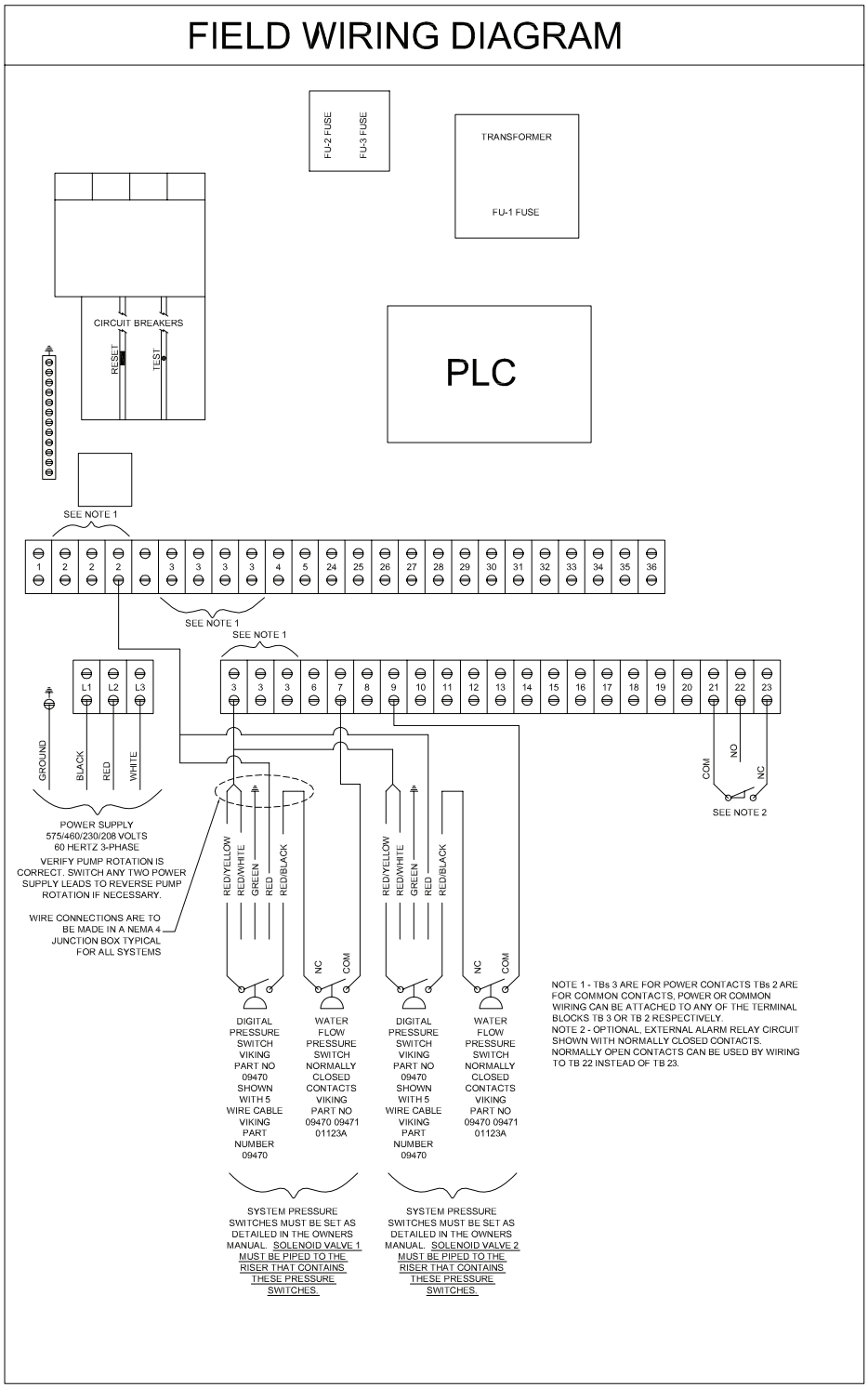

FIELD WIRING DIAGRAM
FU-2 FUSE
FU-3 FUSE
TRANSFORMER
FU-1 FUSE
CIRCUIT BREAKERS
RESET
TEST
PLC
SEE NOTE 1
SEE NOTE 1
SEE NOTE 1
L1
L2
L3
GROUND
BLACK
RED
WHITE
POWER SUPPLY
575/460/230/208 VOLTS
60 HERTZ 3-PHASE
VERIFY PUMP ROTATION IS CORRECT. SWITCH ANY TWO POWER SUPPLY LEADS TO REVERSE PUMP ROTATION IF NECESSARY.
WIRE CONNECTIONS ARE TO BE MADE IN A NEMA 4 JUNCTION BOX TYPICAL FOR ALL SYSTEMS
COM
NO
NC
SEE NOTE 2
RED/YELLOW
RED/WHITE
GREEN
RED
RED/BLACK
NC
COM
DIGITAL PRESSURE SWITCH VIKING PART NO 09470 SHOWN WITH 5 WIRE CABLE VIKING PART NUMBER 09470
WATER FLOW PRESSURE SWITCH NORMALLY CLOSED CONTACTS VIKING PART NO 09470 09471 01123A
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 1 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 2 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
NOTE 1 - TBs 3 ARE FOR POWER CONTACTS TBs 2 ARE FOR COMMON CONTACTS, POWER OR COMMON WIRING CAN BE ATTACHED TO ANY OF THE TERMINAL BLOCKS TB 3 OR TB 2 RESPECTIVELY.
NOTE 2 - OPTIONAL, EXTERNAL ALARM RELAY CIRCUIT SHOWN WITH NORMALLY CLOSED CONTACTS. NORMALLY OPEN CONTACTS CAN BE USED BY WIRING TO TB 22 INSTEAD OF TB 23.

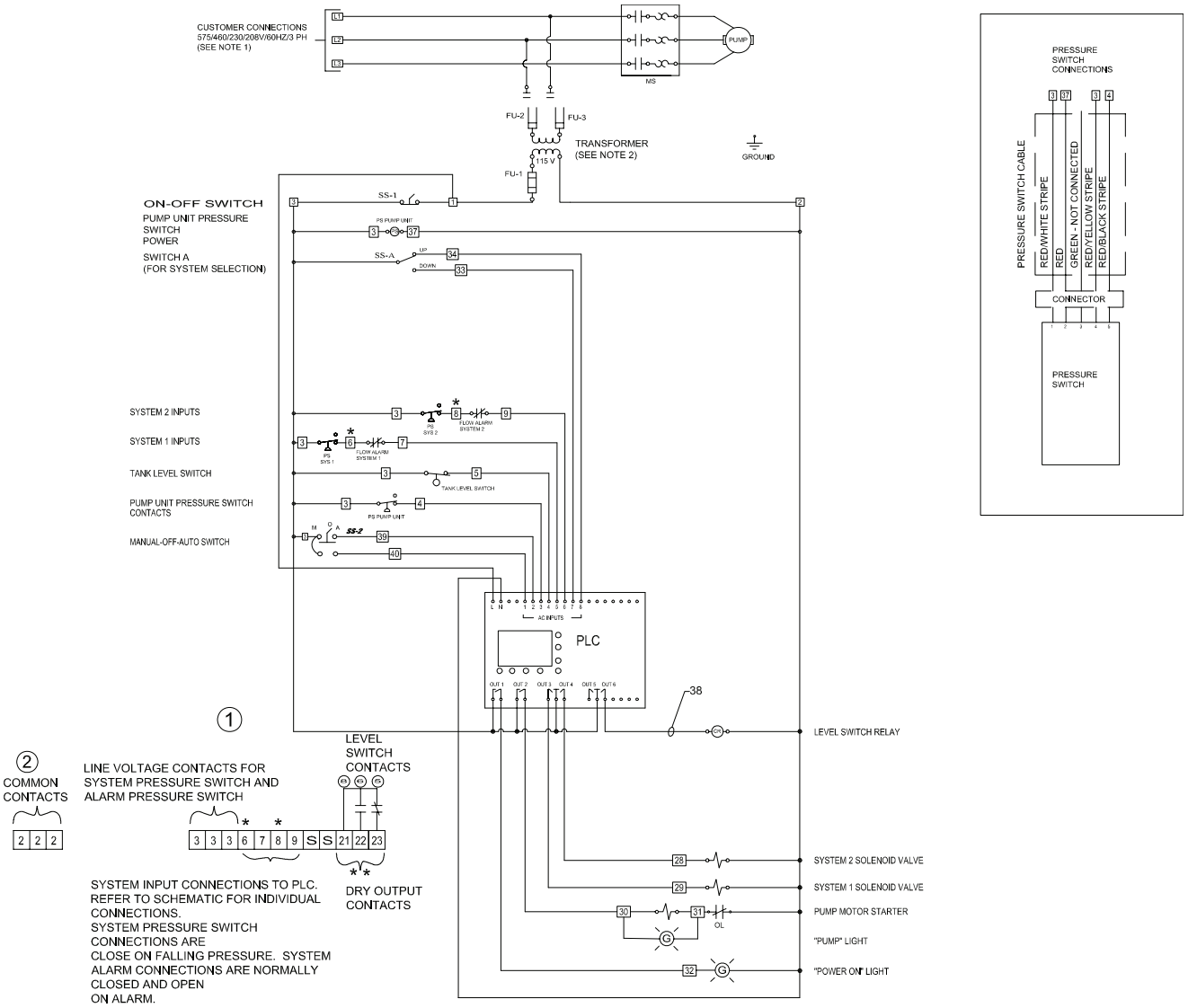
Figure 42a - Wiring Diagram 13050-2
60 Hz - 2 Solenoids

VIKING®

TECHNICAL DATA

ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



② * TERMINAL BLOCKS 6 AND 8 CAN BE USED TO CONNECT THE SYSTEM PRESSURE SWITCH TO THE ALARM PRESSURE SWITCH. ALTERNATIVELY, THIS CONNECTION CAN BE MADE IN A NEMA 4 JUNCTION BOX IF DESIRED. SEE SECTION 8.2 OF THE OWNERS MANUAL FOR WIRING DIAGRAM.

** A LOW FLUID LEVEL VISUAL OR AUDIBLE INDICATOR CAN BE FIELD SPECIFIED AND INSTALLED. TERMINAL BLOCK 21 IS THE COMMON CONTACT, TERMINAL 22 IS CONNECTED TO THE NORMALLY OPEN CIRCUIT OF THE LEVEL SWITCH, AND TERMINAL BLOCK 23 IS CONNECTED TO THE NORMALLY CLOSED CIRCUIT OF THE LEVEL SWITCH.

NOTES:
1) INPUT VOLTAGE IS CONNECTED TO TERMINALS L1, L2 AND L3.
2) TRANSFORMER CONNECTIONS ARE DETERMINED BY SUPPLY VOLTAGE.

SYSTEM SELECTION IN FILL MODE (HAND) AS FOLLOWS:
SYSTEM 1 SWITCH A - UP
SYSTEM 2 SWITCH A -DOWN

Figure 42b - Wiring Diagram 13050-2
60 Hz - 2 Solenoids

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

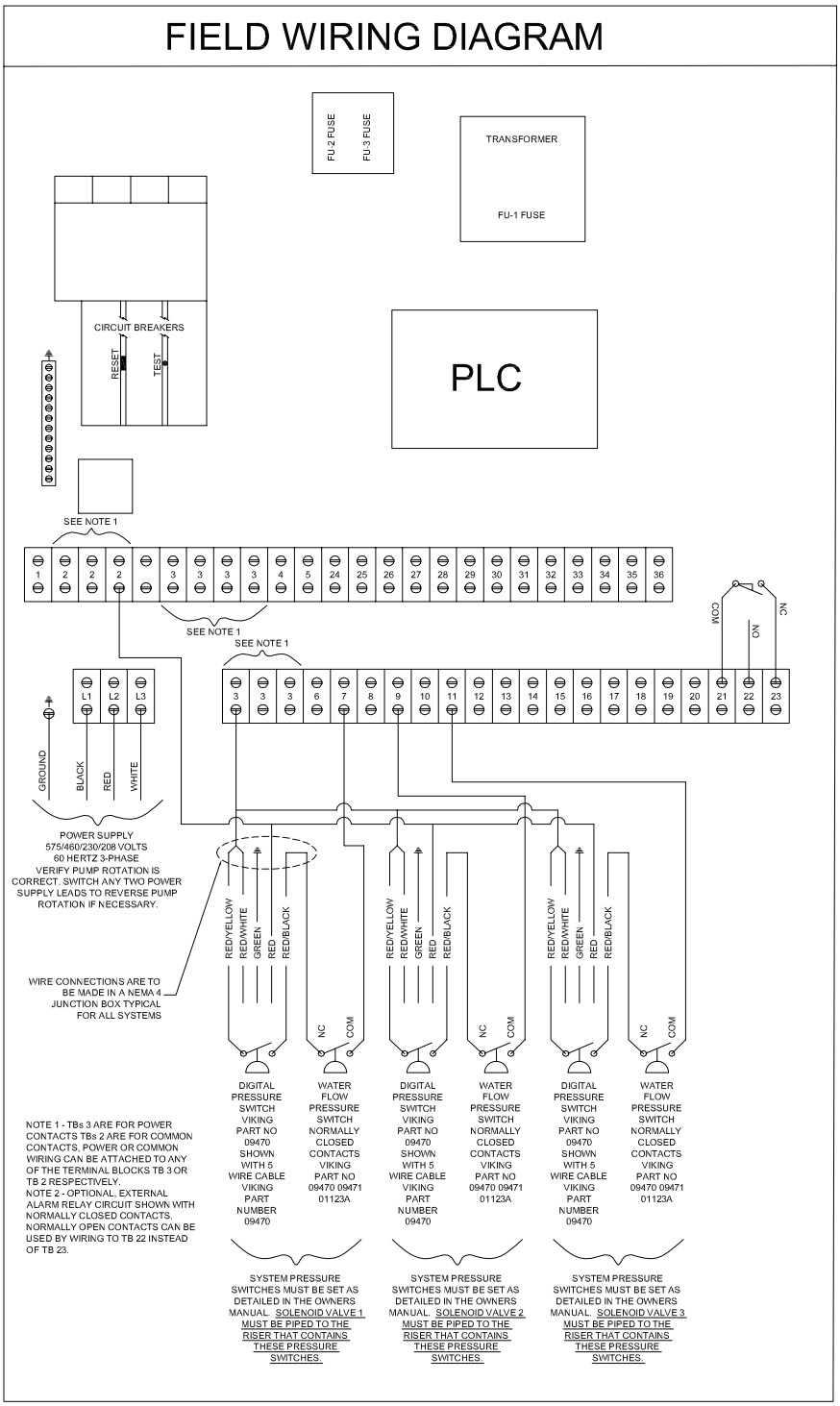

FIELD WIRING DIAGRAM
FU-2 FUSE
FU-3 FUSE
TRANSFORMER
FU-1 FUSE
CIRCUIT BREAKERS
RESET
TEST
PLC
SEE NOTE 1
SEE NOTE 1
SEE NOTE 1
COM
NO
NC
L1
L2
L3
GROUND
BLACK
RED
WHITE
POWER SUPPLY
575/460/230/208 VOLTS
60 HERTZ 3-PHASE
VERIFY PUMP ROTATION IS CORRECT. SWITCH ANY TWO POWER SUPPLY LEADS TO REVERSE PUMP ROTATION IF NECESSARY.
WIRE CONNECTIONS ARE TO BE MADE IN A NEMA 4 JUNCTION BOX TYPICAL FOR ALL SYSTEMS
RED/YELLOW
RED/WHITE
GREEN
RED
RED/BLACK
NC
COM
DIGITAL PRESSURE SWITCH VIKING PART NO 09470 SHOWN WITH 5 WIRE CABLE VIKING PART NUMBER 09470
WATER FLOW PRESSURE SWITCH NORMALLY CLOSED CONTACTS VIKING PART NO 09470 09471 01123A
NOTE 1 - TBs 3 ARE FOR POWER CONTACTS TBs 2 ARE FOR COMMON CONTACTS. POWER OR COMMON WIRING CAN BE ATTACHED TO ANY OF THE TERMINAL BLOCKS TB 3 OR TB 2 RESPECTIVELY.
NOTE 2 - OPTIONAL, EXTERNAL ALARM RELAY CIRCUIT SHOWN WITH NORMALLY CLOSED CONTACTS. NORMALLY OPEN CONTACTS CAN BE USED BY WIRING TO TB 22 INSTEAD OF TB 23.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 1 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 2 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 3 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.

Figure 43a - Wiring Diagram 13050-3
60 Hz - 3 Solenoids

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

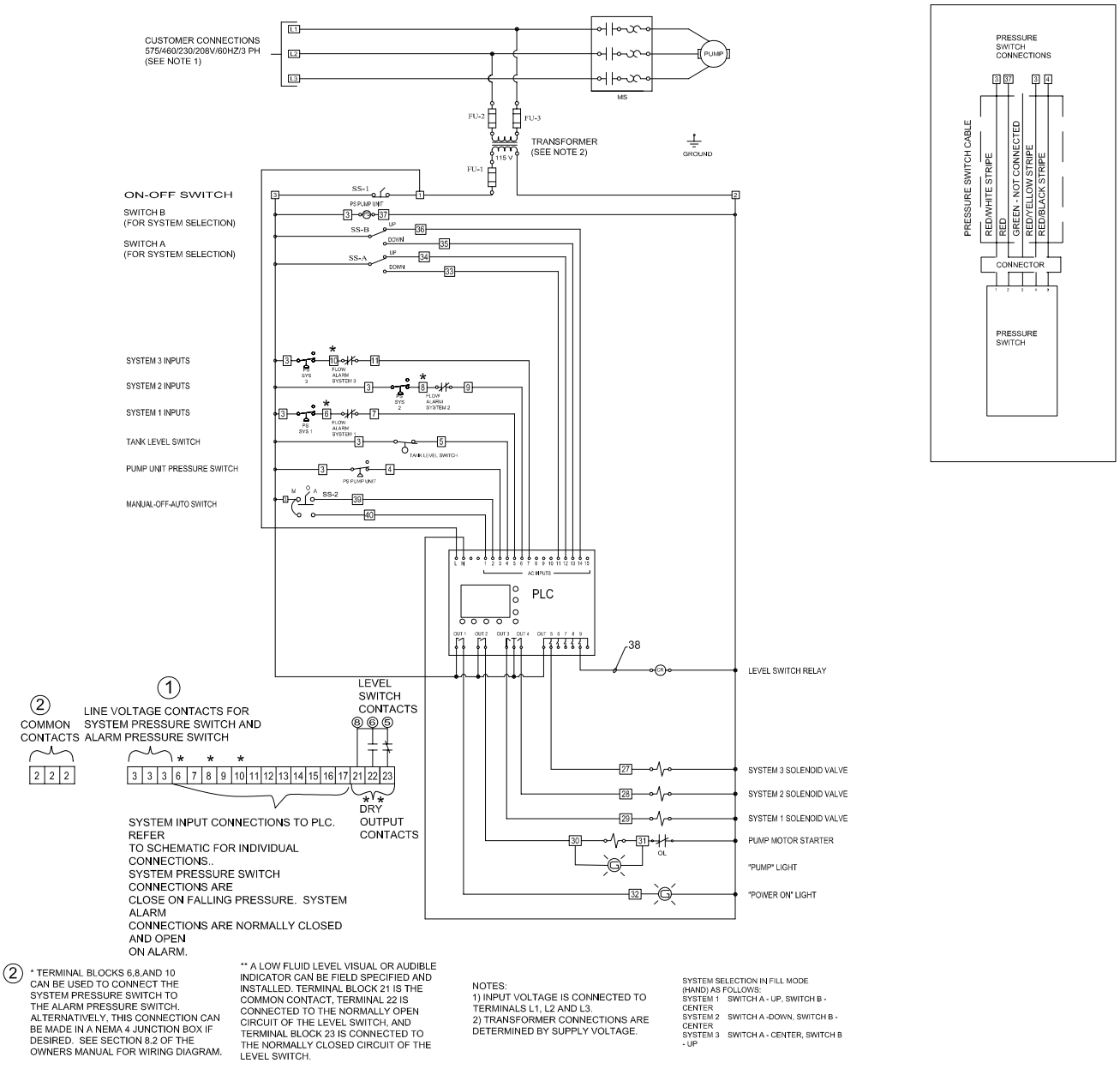

CUSTOMER CONNECTIONS
575/460/230/208V/60HZ/3 PH
(SEE NOTE 1)
L1
L2
L3
PUMP
MS
FU-2
FU-3
FU-1
TRANSFORMER
(SEE NOTE 2)
115 V
GROUND
ON-OFF SWITCH
SWITCH B
(FOR SYSTEM SELECTION)
SWITCH A
(FOR SYSTEM SELECTION)
SS-1
PS PUMP UNIT
SS-B
SS-A
UP
DOWN
SYSTEM 3 INPUTS
SYSTEM 2 INPUTS
SYSTEM 1 INPUTS
TANK LEVEL SWITCH
PUMP UNIT PRESSURE SWITCH
MANUAL-OFF-AUTO SWITCH
SS-2
FLOW ALARM SYSTEM 3
FLOW ALARM SYSTEM 2
FLOW ALARM SYSTEM 1
PS SYS 1
SYS 3
SYS 2
AC INPUTS
PLC
OUT 1
OUT 2
OUT 3
OUT 4
38
LEVEL SWITCH RELAY
SYSTEM 3 SOLENOID VALVE
SYSTEM 2 SOLENOID VALVE
SYSTEM 1 SOLENOID VALVE
PUMP MOTOR STARTER
OL
"PUMP" LIGHT
"POWER ON" LIGHT
COMMON CONTACTS
LINE VOLTAGE CONTACTS FOR SYSTEM PRESSURE SWITCH AND ALARM PRESSURE SWITCH
LEVEL SWITCH CONTACTS
DRY OUTPUT CONTACTS
SYSTEM INPUT CONNECTIONS TO PLC. REFER TO SCHEMATIC FOR INDIVIDUAL CONNECTIONS..
SYSTEM PRESSURE SWITCH CONNECTIONS ARE CLOSE ON FALLING PRESSURE. SYSTEM ALARM CONNECTIONS ARE NORMALLY CLOSED AND OPEN ON ALARM.
* TERMINAL BLOCKS 6,8,AND 10 CAN BE USED TO CONNECT THE SYSTEM PRESSURE SWITCH TO THE ALARM PRESSURE SWITCH. ALTERNATIVELY, THIS CONNECTION CAN BE MADE IN A NEMA 4 JUNCTION BOX IF DESIRED. SEE SECTION 8.2 OF THE OWNERS MANUAL FOR WIRING DIAGRAM.
** A LOW FLUID LEVEL VISUAL OR AUDIBLE INDICATOR CAN BE FIELD SPECIFIED AND INSTALLED. TERMINAL BLOCK 21 IS THE COMMON CONTACT, TERMINAL 22 IS CONNECTED TO THE NORMALLY OPEN CIRCUIT OF THE LEVEL SWITCH, AND TERMINAL BLOCK 23 IS CONNECTED TO THE NORMALLY CLOSED CIRCUIT OF THE LEVEL SWITCH.
NOTES:
1) INPUT VOLTAGE IS CONNECTED TO TERMINALS L1, L2 AND L3.
2) TRANSFORMER CONNECTIONS ARE DETERMINED BY SUPPLY VOLTAGE.
SYSTEM SELECTION IN FILL MODE (HAND) AS FOLLOWS:
SYSTEM 1 SWITCH A - UP, SWITCH B - CENTER
SYSTEM 2 SWITCH A -DOWN, SWITCH B - CENTER
SYSTEM 3 SWITCH A - CENTER, SWITCH B - UP
PRESSURE SWITCH CONNECTIONS
PRESSURE SWITCH CABLE
RED/WHITE STRIPE
RED
GREEN - NOT CONNECTED
RED/YELLOW STRIPE
RED/BLACK STRIPE
CONNECTOR
PRESSURE SWITCH

Figure 43b - Wiring Diagram 13050-3
60 Hz - 3 Solenoids

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

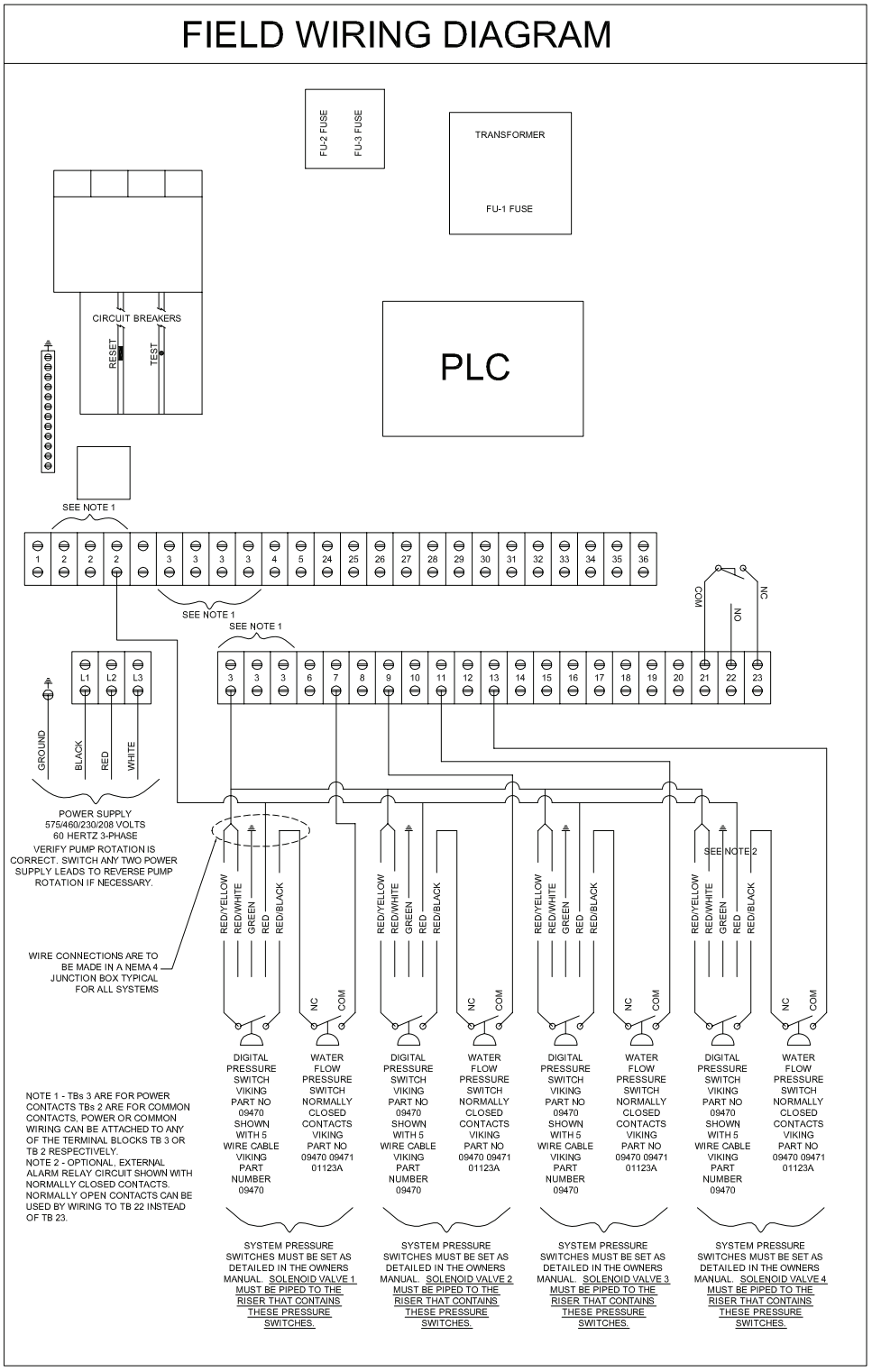
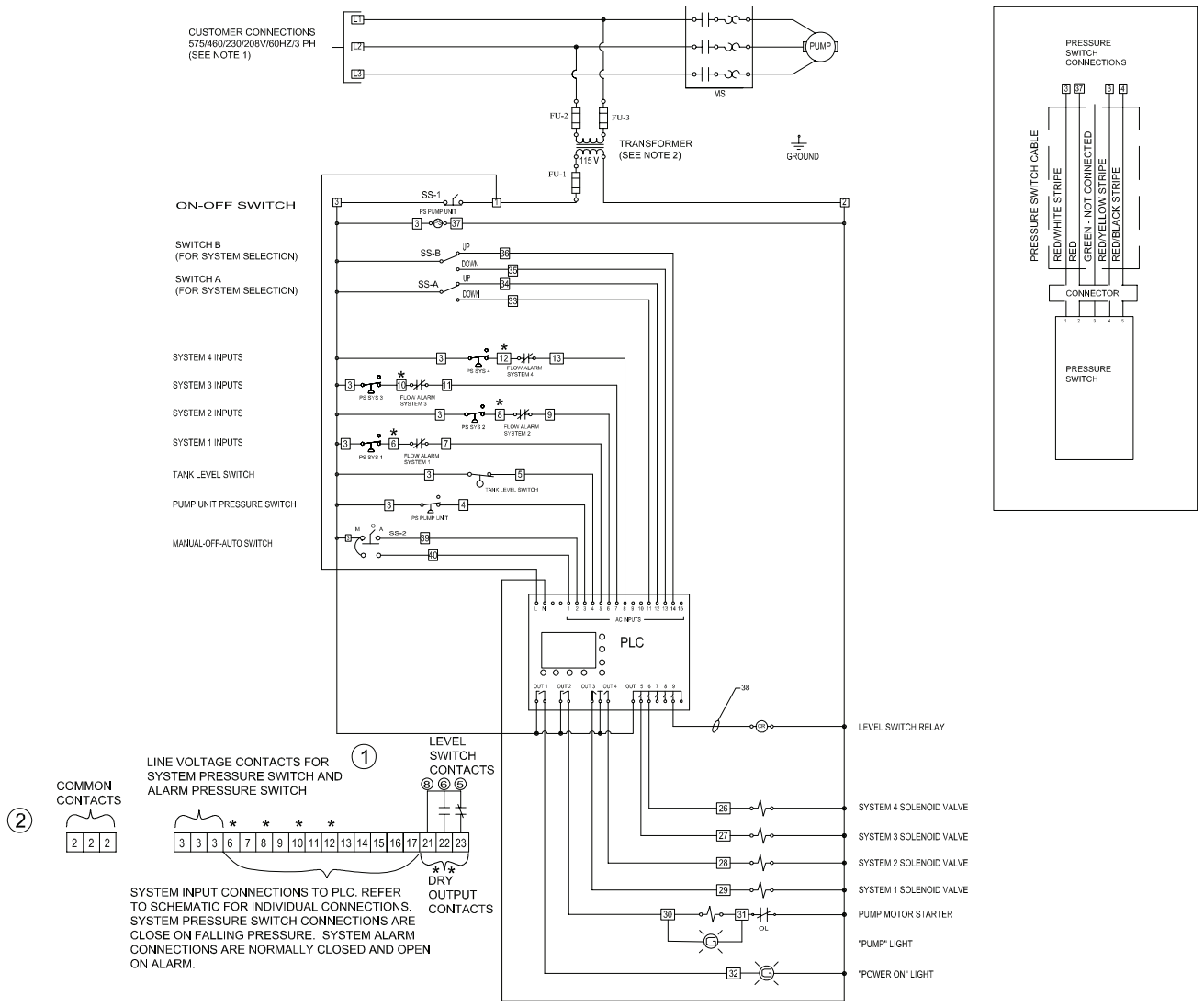

FIELD WIRING DIAGRAM
FU-2 FUSE
FU-3 FUSE
TRANSFORMER
FU-1 FUSE
CIRCUIT BREAKERS
RESET
TEST
PLC
SEE NOTE 1
SEE NOTE 1
SEE NOTE 1
COM
NO
ON
L1
L2
L3
GROUND
BLACK
RED
WHITE
POWER SUPPLY
575/460/230/208 VOLTS
60 HERTZ 3-PHASE
VERIFY PUMP ROTATION IS CORRECT. SWITCH ANY TWO POWER SUPPLY LEADS TO REVERSE PUMP ROTATION IF NECESSARY.
WIRE CONNECTIONS ARE TO BE MADE IN A NEMA 4 JUNCTION BOX TYPICAL FOR ALL SYSTEMS
SEE NOTE 2
RED/YELLOW
RED/WHITE
GREEN
RED
RED/BLACK
NC
COM
DIGITAL PRESSURE SWITCH VIKING PART NO 09470 SHOWN WITH 5 WIRE CABLE VIKING PART NUMBER 09470
WATER FLOW PRESSURE SWITCH NORMALLY CLOSED CONTACTS VIKING PART NO 09470 09471 01123A
NOTE 1 - TBs 3 ARE FOR POWER CONTACTS TBs 2 ARE FOR COMMON CONTACTS, POWER OR COMMON WIRING CAN BE ATTACHED TO ANY OF THE TERMINAL BLOCKS TB 3 OR TB 2 RESPECTIVELY.
NOTE 2 - OPTIONAL, EXTERNAL ALARM RELAY CIRCUIT SHOWN WITH NORMALLY CLOSED CONTACTS. NORMALLY OPEN CONTACTS CAN BE USED BY WIRING TO TB 22 INSTEAD OF TB 23.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 1 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 2 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 3 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 4 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.

Figure 44a - Wiring Diagram 13050-4
60 Hz - 4 Solenoids

TECHNICAL DATA

ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



② * TERMINAL BLOCKS 6,8,10, AND 12 CAN BE USED TO CONNECT THE SYSTEM PRESSURE SWITCH TO THE ALARM PRESSURE SWITCH. ALTERNATIVELY, THIS CONNECTION CAN BE MADE IN A NEMA 4 JUNCTION BOX IF DESIRED. SEE SECTION 8.2 OF THE OWNERS MANUAL FOR WIRING DIAGRAM.

** A LOW FLUID LEVEL VISUAL OR AUDIBLE INDICATOR CAN BE FIELD SPECIFIED AND INSTALLED. TERMINAL BLOCK 21 IS THE COMMON CONTACT, TERMINAL 22 IS CONNECTED TO THE NORMALLY OPEN CIRCUIT OF THE LEVEL SWITCH, AND TERMINAL BLOCK 23 IS CONNECTED TO THE NORMALLY CLOSED CIRCUIT OF THE LEVEL SWITCH.

NOTES:
1) INPUT VOLTAGE IS CONNECTED TO TERMINALS L1, L2 AND L3.
2) TRANSFORMER CONNECTIONS ARE DETERMINED BY SUPPLY VOLTAGE.

SYSTEM SELECTION IN FILL MODE (HAND) AS FOLLOWS:
SYSTEM 1 SWITCH A - UP, SWITCH B - CENTER
SYSTEM 2 SWITCH A -DOWN, SWITCH B - CENTER
SYSTEM 3 SWITCH A - CENTER, SWITCH B - UP
SYSTEM 4 SWITCH A - CENTER, SWITCH B - DOWN

Figure 44b - Wiring Diagram 13050-4
60 Hz - 4 Solenoids

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

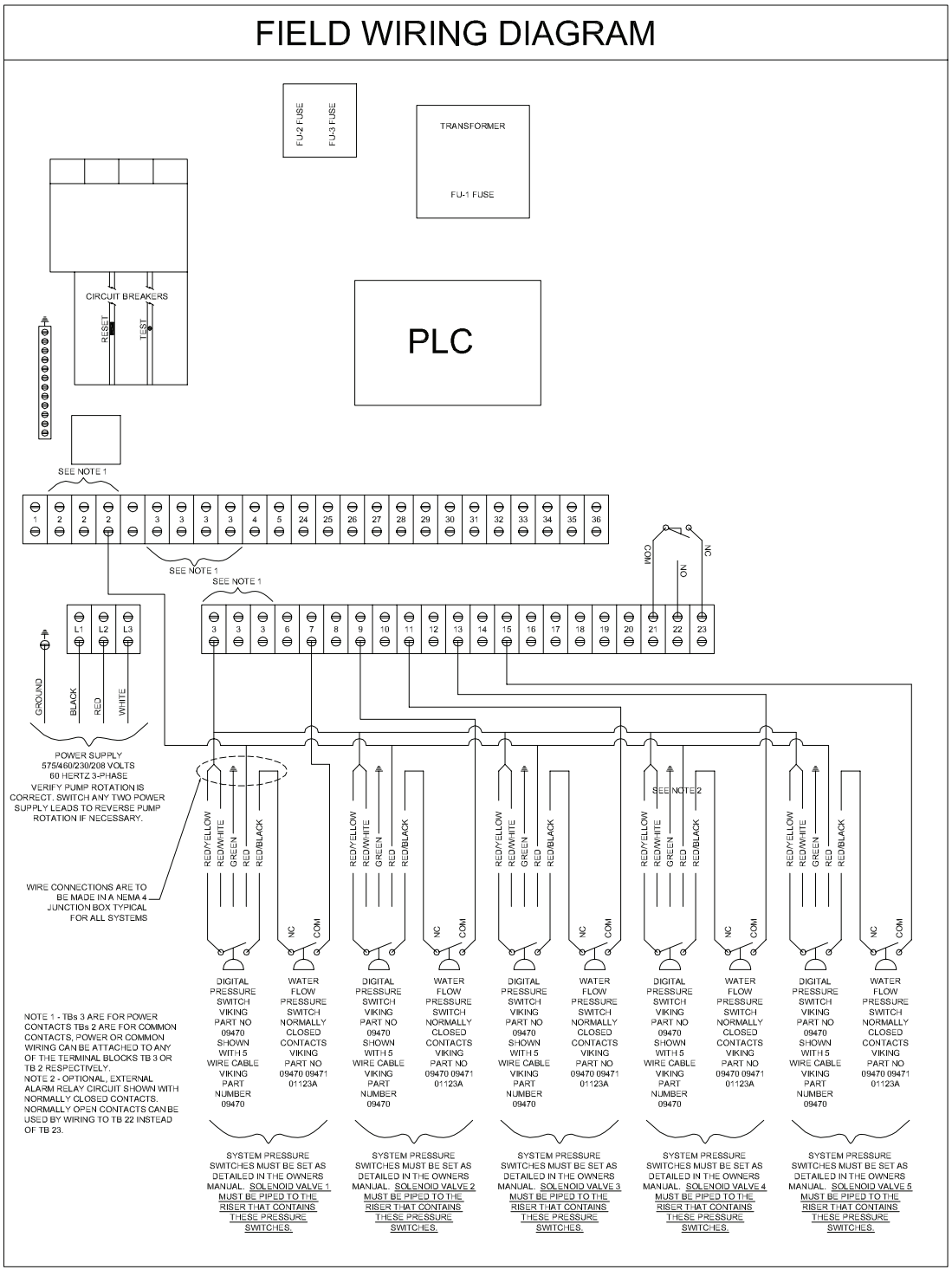
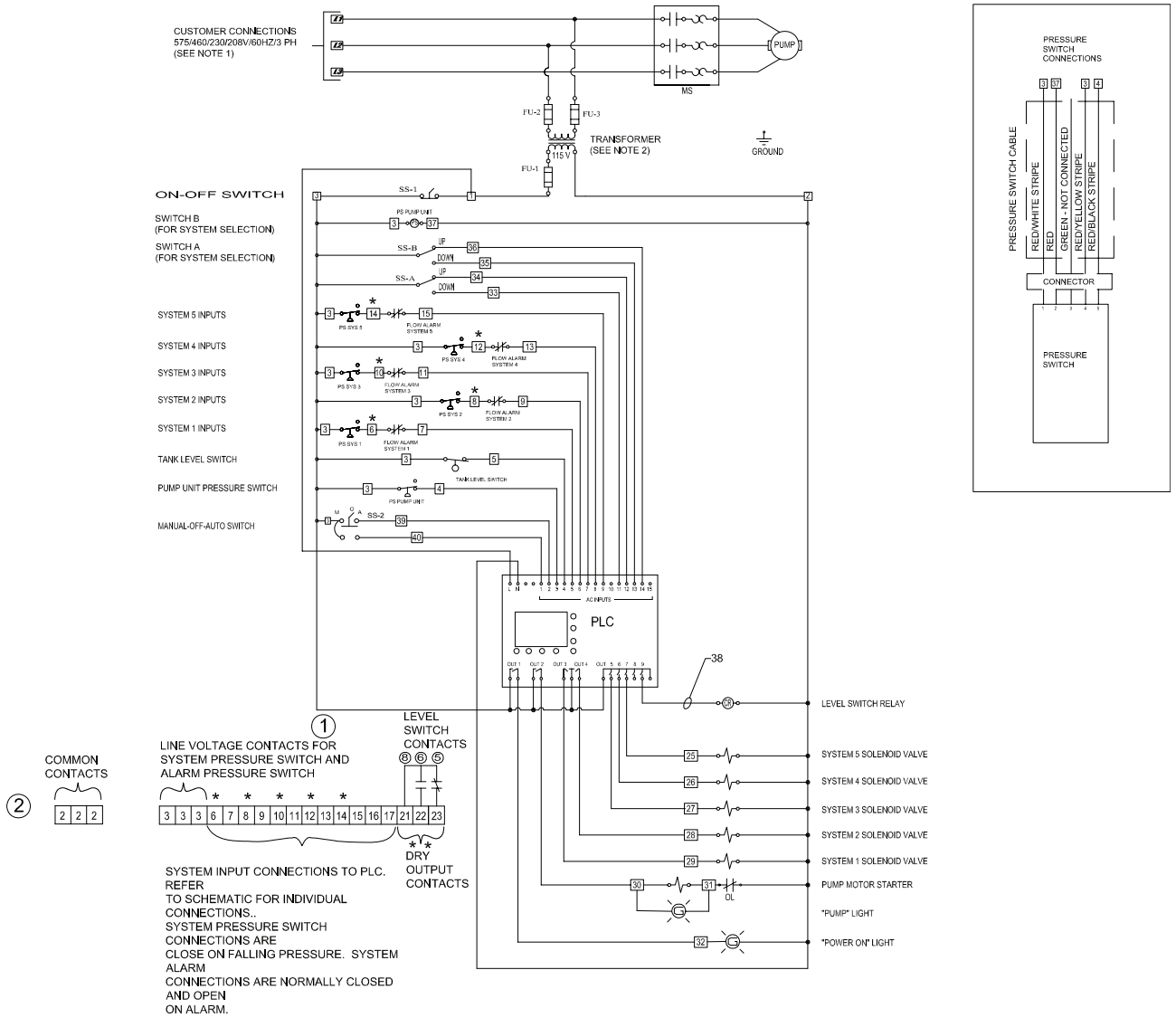

FIELD WIRING DIAGRAM
FU-2 FUSE
FU-3 FUSE
TRANSFORMER
FU-1 FUSE
CIRCUIT BREAKERS
RESET
TEST
PLC
SEE NOTE 1
SEE NOTE 1
SEE NOTE 1
COM
NO
NC
L1
L2
L3
GROUND
BLACK
RED
WHITE
POWER SUPPLY
575/460/230/208 VOLTS
60 HERTZ 3-PHASE
VERIFY PUMP ROTATION IS CORRECT. SWITCH ANY TWO POWER SUPPLY LEADS TO REVERSE PUMP ROTATION IF NECESSARY.
WIRE CONNECTIONS ARE TO BE MADE IN A NEMA 4 JUNCTION BOX TYPICAL FOR ALL SYSTEMS
RED/YELLOW
RED/WHITE
GREEN
RED
RED/BLACK
SEE NOTE 2
DIGITAL PRESSURE SWITCH VIKING PART NO 09470 SHOWN WITH 5 WIRE CABLE VIKING PART NUMBER 09470
WATER FLOW PRESSURE SWITCH NORMALLY CLOSED CONTACTS VIKING PART NO 09470 09471 01123A
NOTE 1 - TBs 3 ARE FOR POWER CONTACTS TBs 2 ARE FOR COMMON CONTACTS, POWER OR COMMON WIRING CAN BE ATTACHED TO ANY OF THE TERMINAL BLOCKS TB 3 OR TB 2 RESPECTIVELY.
NOTE 2 - OPTIONAL, EXTERNAL ALARM RELAY CIRCUIT SHOWN WITH NORMALLY CLOSED CONTACTS. NORMALLY OPEN CONTACTS CAN BE USED BY WIRING TO TB 22 INSTEAD OF TB 23.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 1 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 2 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 3 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 4 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 5 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.

Figure 45a - Wiring Diagram 13050-5
60 Hz - 5 Solenoids

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



② * TERMINAL BLOCKS 6,8,10, 12, AND 14, CAN BE USED TO CONNECT THE SYSTEM PRESSURE SWITCH TO THE ALARM PRESSURE SWITCH. ALTERNATIVELY, THIS CONNECTION CAN BE MADE IN A NEMA 4 JUNCTION BOX IF DESIRED. SEE SECTION 8.2 OF THE OWNERS MANUAL FOR WIRING DIAGRAM.

** A LOW FLUID LEVEL VISUAL OR AUDIBLE INDICATOR CAN BE FIELD SPECIFIED AND INSTALLED. TERMINAL BLOCK 21 IS THE COMMON CONTACT, TERMINAL 22 IS CONNECTED TO THE NORMALLY OPEN CIRCUIT OF THE LEVEL SWITCH, AND TERMINAL BLOCK 23 IS CONNECTED TO THE NORMALLY CLOSED CIRCUIT OF THE LEVEL SWITCH.

NOTES:
1) INPUT VOLTAGE IS CONNECTED TO TERMINALS L1, L2 AND L3.
2) TRANSFORMER CONNECTIONS ARE DETERMINED BY SUPPLY VOLTAGE.

SYSTEM SELECTION IN FILL MODE (HAND) AS FOLLOWS:
SYSTEM 1 SWITCH A - UP, SWITCH B - CENTER
SYSTEM 2 SWITCH A -DOWN, SWITCH B - CENTER
SYSTEM 3 SWITCH A - CENTER, SWITCH B - UP
SYSTEM 4 SWITCH A - CENTER, SWITCH B - DOWN
SYSTEM 5 SWITCH A - UP, SWITCH B - UP
SYSTEM 6 SWITCH A - DOWN, SWITCH B - DOWN (N/A)

Figure 45b - Wiring Diagram 13050-5
60 Hz - 5 Solenoids

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

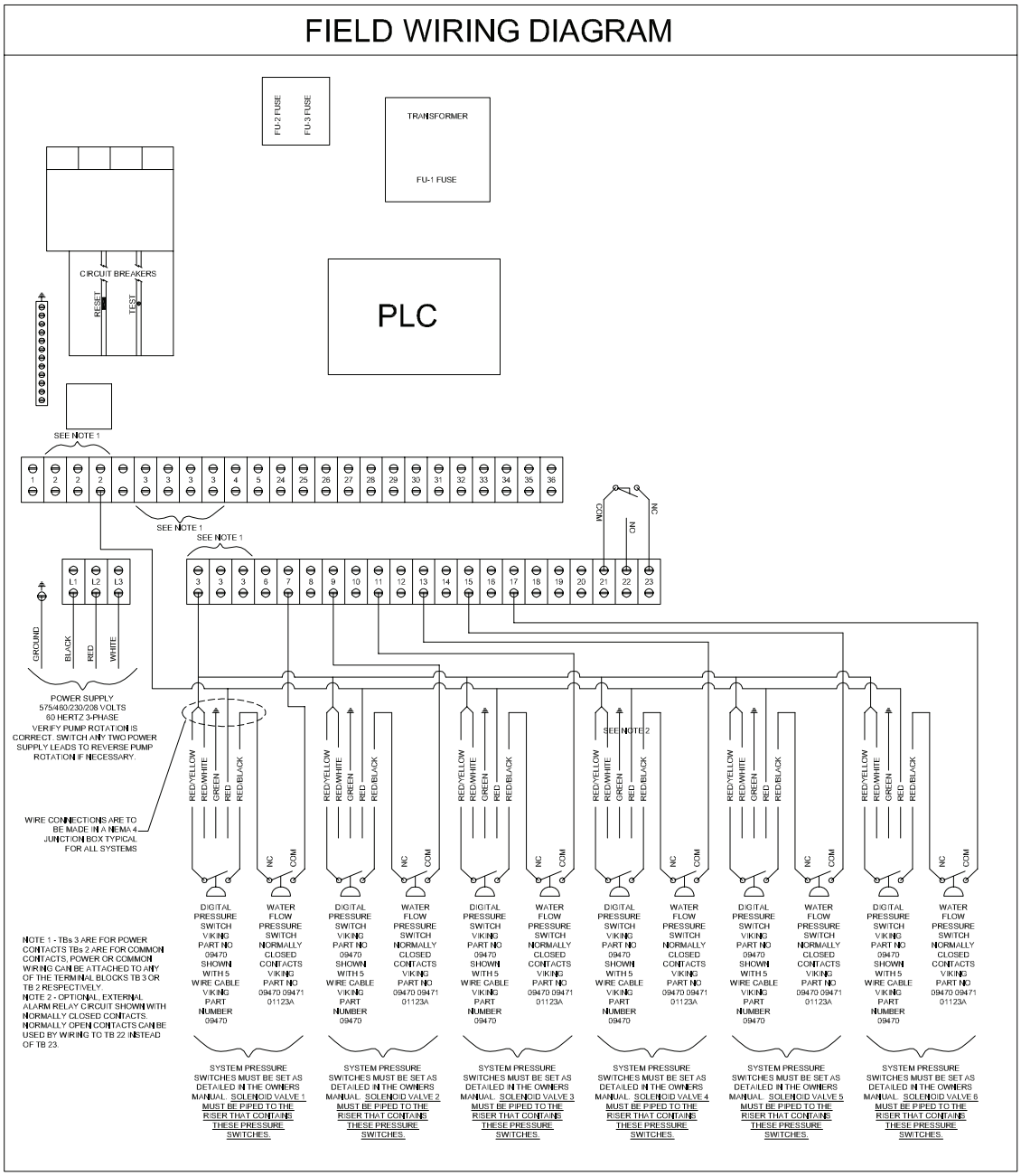
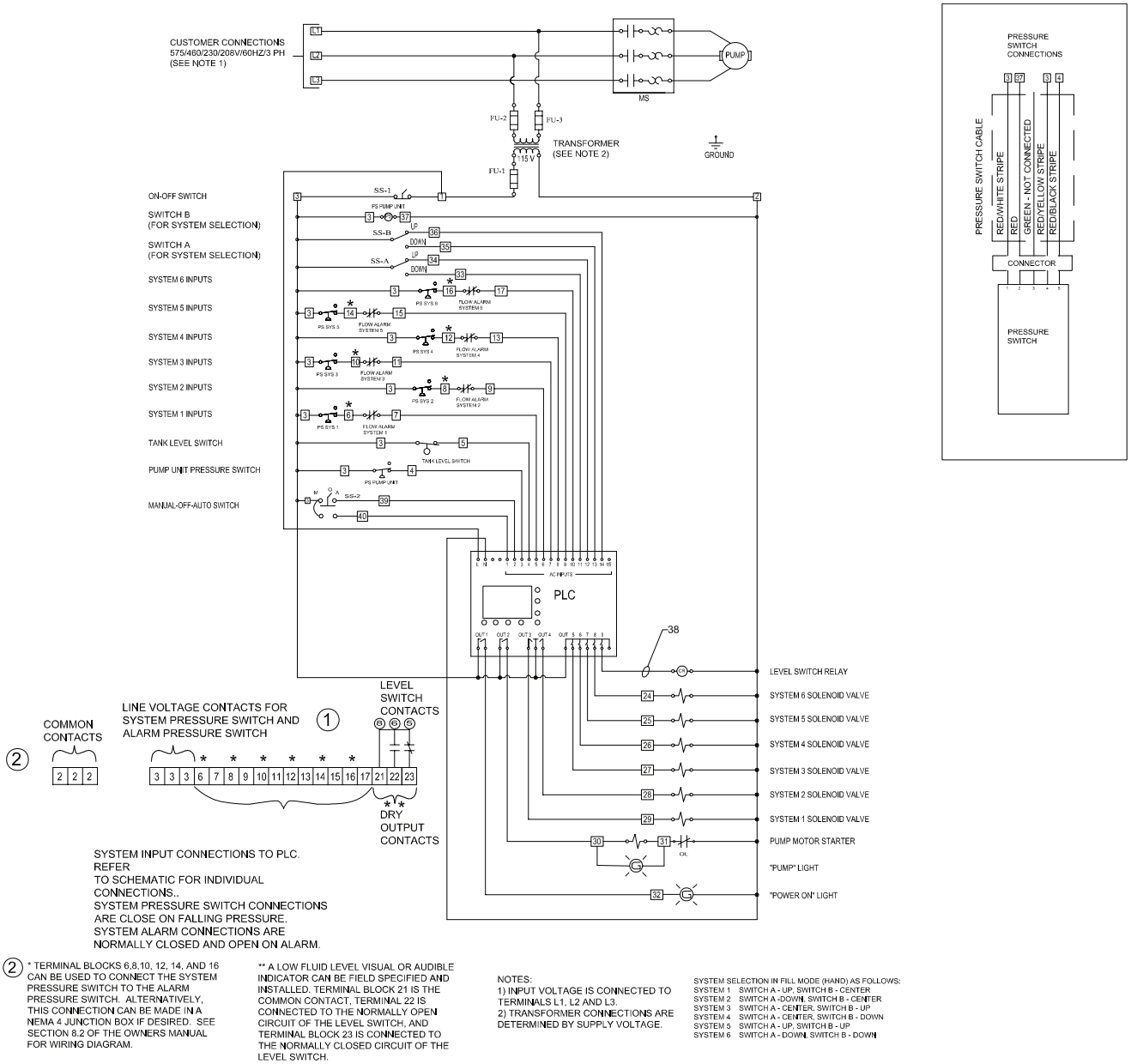

FIELD WIRING DIAGRAM
FU-2 FUSE
FU-3 FUSE
TRANSFORMER
FU-1 FUSE
CIRCUIT BREAKERS
RESET
TEST
PLC
SEE NOTE 1
SEE NOTE 1
SEE NOTE 1
COM
NO
NC
L1
L2
L3
GROUND
BLACK
RED
WHITE
POWER SUPPLY
575/460/230/208 VOLTS
60 HERTZ 3-PHASE.
VERIFY PUMP ROTATION IS CORRECT. SWITCH ANY TWO POWER SUPPLY LEADS TO REVERSE PUMP ROTATION IF NECESSARY.
WIRE CONNECTIONS ARE TO BE MADE IN A NEMA 4 JUNCTION BOX TYPICAL FOR ALL SYSTEMS
SEE NOTE 2
RED/YELLOW
RED/WHITE
GREEN
RED
RED/BLACK
NC
COM
DIGITAL PRESSURE SWITCH VIKING PART NO 09470 SHOWN WITH 5 WIRE CABLE VIKING PART NUMBER 09470
WATER FLOW PRESSURE SWITCH NORMALLY CLOSED CONTACTS VIKING PART NO 09470 09471 01123A
NOTE 1 - TBs 3 ARE FOR POWER CONTACTS TBs 2 ARE FOR COMMON CONTACTS, POWER OR COMMON WIRING CAN BE ATTACHED TO ANY OF THE TERMINAL BLOCKS TB 3 OR TB 2 RESPECTIVELY.
NOTE 2 - OPTIONAL EXTERNAL ALARM RELAY CIRCUIT SHOWN WITH NORMALLY CLOSED CONTACTS. NORMALLY OPEN CONTACTS CAN BE USED BY WIRING TO TB 22 INSTEAD OF TB 23.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 1 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 2 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 3 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 4 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 5 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 6 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.

Figure 46a - Wiring Diagram 13050-6
60 Hz - 6 Solenoids

TECHNICAL DATA

ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



(2) * TERMINAL BLOCKS 6,8,10, 12, 14, AND 16 CAN BE USED TO CONNECT THE SYSTEM PRESSURE SWITCH TO THE ALARM PRESSURE SWITCH. ALTERNATIVELY, THIS CONNECTION CAN BE MADE IN A NEMA 4 JUNCTION BOX IF DESIRED. SEE SECTION 8.2 OF THE OWNERS MANUAL FOR WIRING DIAGRAM.

** A LOW FLUID LEVEL VISUAL OR AUDIBLE INDICATOR CAN BE FIELD SPECIFIED AND INSTALLED. TERMINAL BLOCK 21 IS THE COMMON CONTACT, TERMINAL 22 IS CONNECTED TO THE NORMALLY OPEN CIRCUIT OF THE LEVEL SWITCH, AND TERMINAL BLOCK 23 IS CONNECTED TO THE NORMALLY CLOSED CIRCUIT OF THE LEVEL SWITCH.

NOTES:
1) INPUT VOLTAGE IS CONNECTED TO TERMINALS L1, L2 AND L3.
2) TRANSFORMER CONNECTIONS ARE DETERMINED BY SUPPLY VOLTAGE.

SYSTEM SELECTION IN FILL MODE (HAND) AS FOLLOWS:
SYSTEM 1 SWITCH A - UP, SWITCH B - CENTER
SYSTEM 2 SWITCH A -DOWN, SWITCH B - CENTER
SYSTEM 3 SWITCH A - CENTER, SWITCH B - UP
SYSTEM 4 SWITCH A - CENTER, SWITCH B - DOWN
SYSTEM 5 SWITCH A - UP, SWITCH B - UP
SYSTEM 6 SWITCH A - DOWN, SWITCH B - DOWN

Figure 46b - Wiring Diagram 13050-6
60 Hz - 6 Solenoids

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

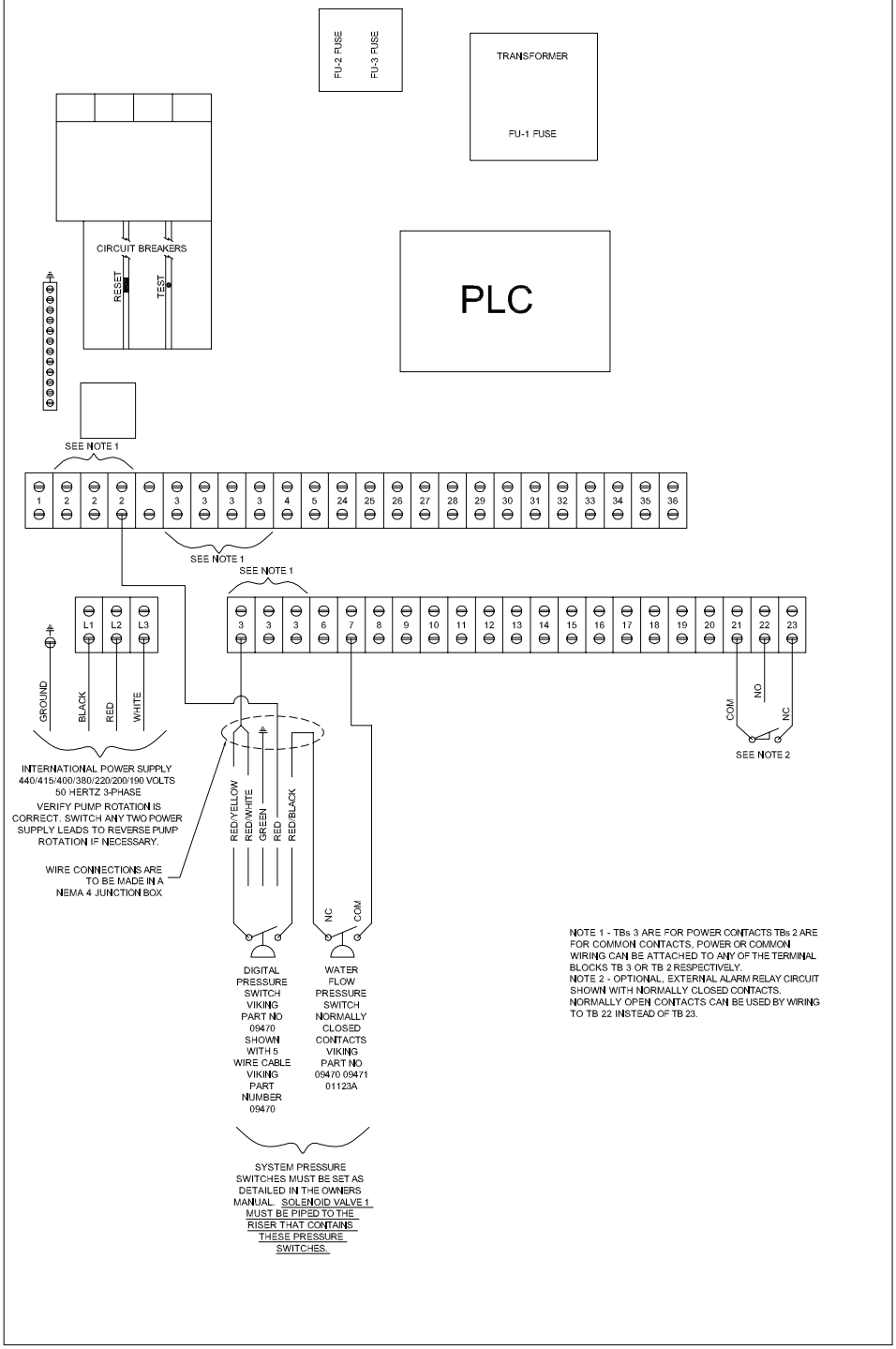

FIELD WIRING DIAGRAM
FU-2 FUSE
FU-3 FUSE
TRANSFORMER
FU-1 FUSE
CIRCUIT BREAKERS
RESET
TEST
PLC
SEE NOTE 1
SEE NOTE 1
SEE NOTE 1
L1 L2 L3
GROUND
BLACK
RED
WHITE
INTERNATIONAL POWER SUPPLY
440/415/400/380/220/200/190 VOLTS
50 HERTZ 3-PHASE
VERIFY PUMP ROTATION IS CORRECT. SWITCH ANY TWO POWER SUPPLY LEADS TO REVERSE PUMP ROTATION IF NECESSARY.
WIRE CONNECTIONS ARE TO BE MADE IN A NEMA 4 JUNCTION BOX
RED/YELLOW
RED/WHITE
GREEN
RED
RED/BLACK
NC
COM
COM
NO
NC
SEE NOTE 2
DIGITAL PRESSURE SWITCH VIKING PART NO 09470 SHOWN WITH 5 WIRE CABLE VIKING PART NUMBER 09470
WATER FLOW PRESSURE SWITCH NORMALLY CLOSED CONTACTS VIKING PART NO 09470 09471 01123A
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 1 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
NOTE 1 - TBs 3 ARE FOR POWER CONTACTS TBs 2 ARE FOR COMMON CONTACTS. POWER OR COMMON WIRING CAN BE ATTACHED TO ANY OF THE TERMINAL BLOCKS TB 3 OR TB 2 RESPECTIVELY.
NOTE 2 - OPTIONAL, EXTERNAL ALARM RELAY CIRCUIT SHOWN WITH NORMALLY CLOSED CONTACTS. NORMALLY OPEN CONTACTS CAN BE USED BY WIRING TO TB 22 INSTEAD OF TB 23.

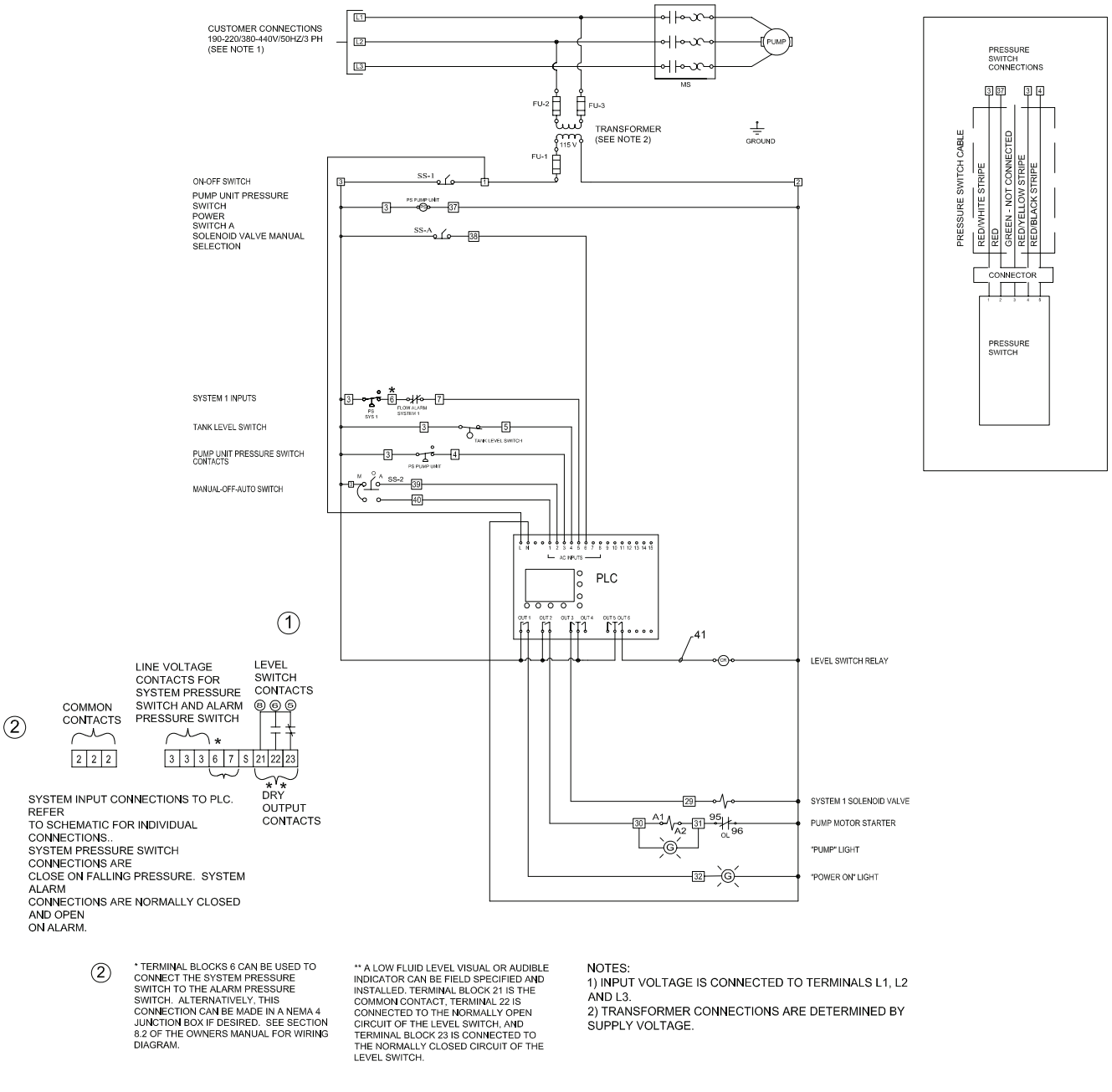
Figure 47a - Wiring Diagram 13051-1
50 Hz - 1 Solenoid

VIKING®

TECHNICAL DATA

ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



② * TERMINAL BLOCKS 6 CAN BE USED TO CONNECT THE SYSTEM PRESSURE SWITCH TO THE ALARM PRESSURE SWITCH. ALTERNATIVELY, THIS CONNECTION CAN BE MADE IN A NEMA 4 JUNCTION BOX IF DESIRED. SEE SECTION 8.2 OF THE OWNERS MANUAL FOR WIRING DIAGRAM.

** A LOW FLUID LEVEL VISUAL OR AUDIBLE INDICATOR CAN BE FIELD SPECIFIED AND INSTALLED. TERMINAL BLOCK 21 IS THE COMMON CONTACT, TERMINAL 22 IS CONNECTED TO THE NORMALLY OPEN CIRCUIT OF THE LEVEL SWITCH, AND TERMINAL BLOCK 23 IS CONNECTED TO THE NORMALLY CLOSED CIRCUIT OF THE LEVEL SWITCH.

NOTES:
1) INPUT VOLTAGE IS CONNECTED TO TERMINALS L1, L2 AND L3.
2) TRANSFORMER CONNECTIONS ARE DETERMINED BY SUPPLY VOLTAGE.

Figure 47b - Wiring Diagram 13051-1
50 Hz - 1 Solenoid

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

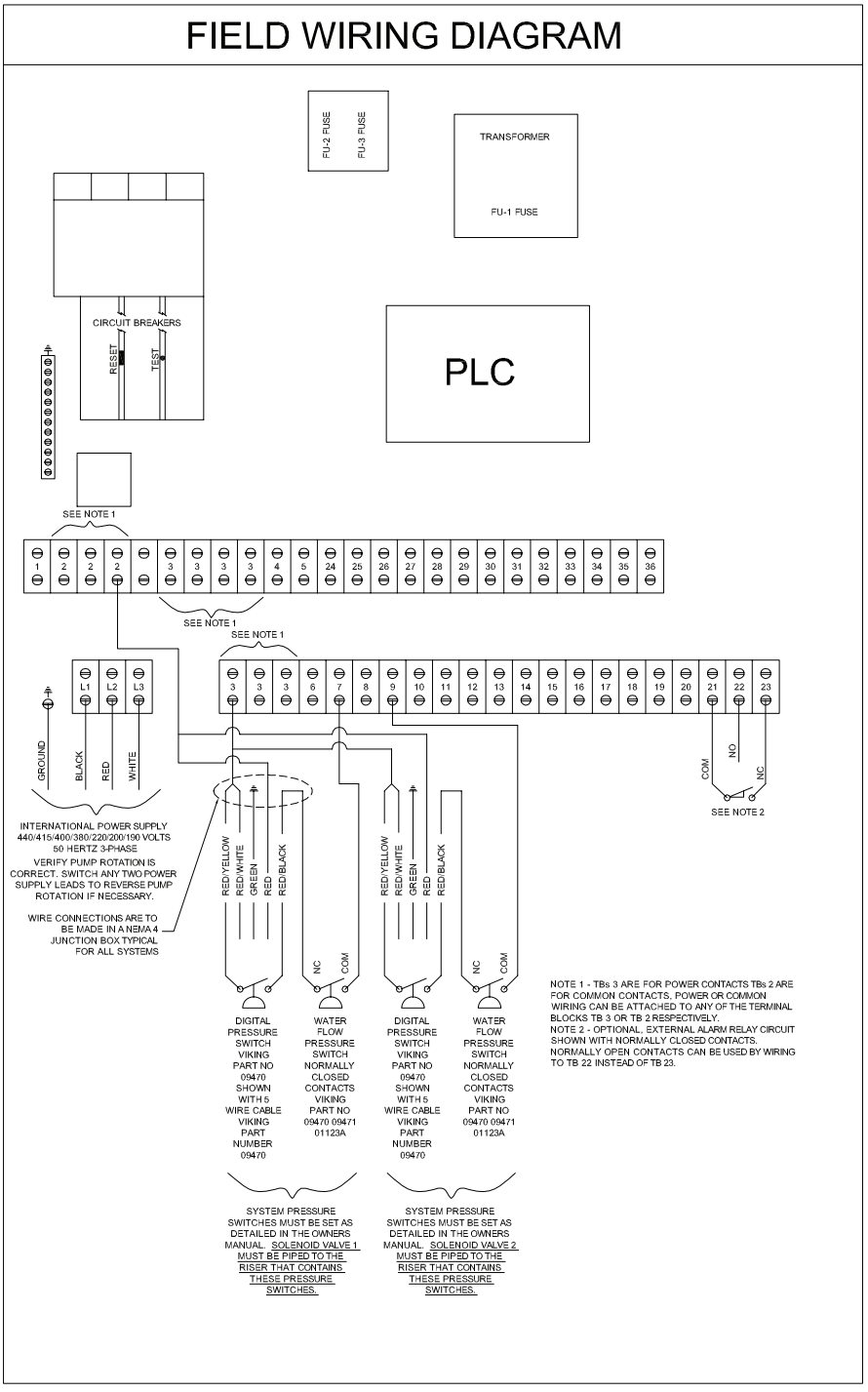

FIELD WIRING DIAGRAM
FU-2 FUSE
FU-3 FUSE
TRANSFORMER
FU-1 FUSE
CIRCUIT BREAKERS
RESET
TEST
PLC
SEE NOTE 1
SEE NOTE 1
SEE NOTE 1
L1
L2
L3
GROUND
BLACK
RED
WHITE
COM
NO
NC
SEE NOTE 2
INTERNATIONAL POWER SUPPLY
440/415/400/380/220/200/190 VOLTS
50 HERTZ 3-PHASE
VERIFY PUMP ROTATION IS CORRECT. SWITCH ANY TWO POWER SUPPLY LEADS TO REVERSE PUMP ROTATION IF NECESSARY.
WIRE CONNECTIONS ARE TO BE MADE IN A NEMA 4 JUNCTION BOX TYPICAL FOR ALL SYSTEMS
RED/YELLOW
RED/WHITE
GREEN
RED
RED/BLACK
NC
COM
DIGITAL PRESSURE SWITCH VIKING PART NO 09470 SHOWN WITH 5 WIRE CABLE VIKING PART NUMBER 09470
WATER FLOW PRESSURE SWITCH NORMALLY CLOSED CONTACTS VIKING PART NO 09470 09471 01123A
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 1 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 2 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
NOTE 1 - TBs 3 ARE FOR POWER CONTACTS TBs 2 ARE FOR COMMON CONTACTS, POWER OR COMMON WIRING CAN BE ATTACHED TO ANY OF THE TERMINAL BLOCKS TB 3 OR TB 2 RESPECTIVELY.
NOTE 2 - OPTIONAL, EXTERNAL ALARM RELAY CIRCUIT SHOWN WITH NORMALLY CLOSED CONTACTS. NORMALLY OPEN CONTACTS CAN BE USED BY WIRING TO TB 22 INSTEAD OF TB 23.

Figure 48a - Wiring Diagram 13051-2
50 Hz - 2 Solenoids

VIKING®

TECHNICAL DATA

ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

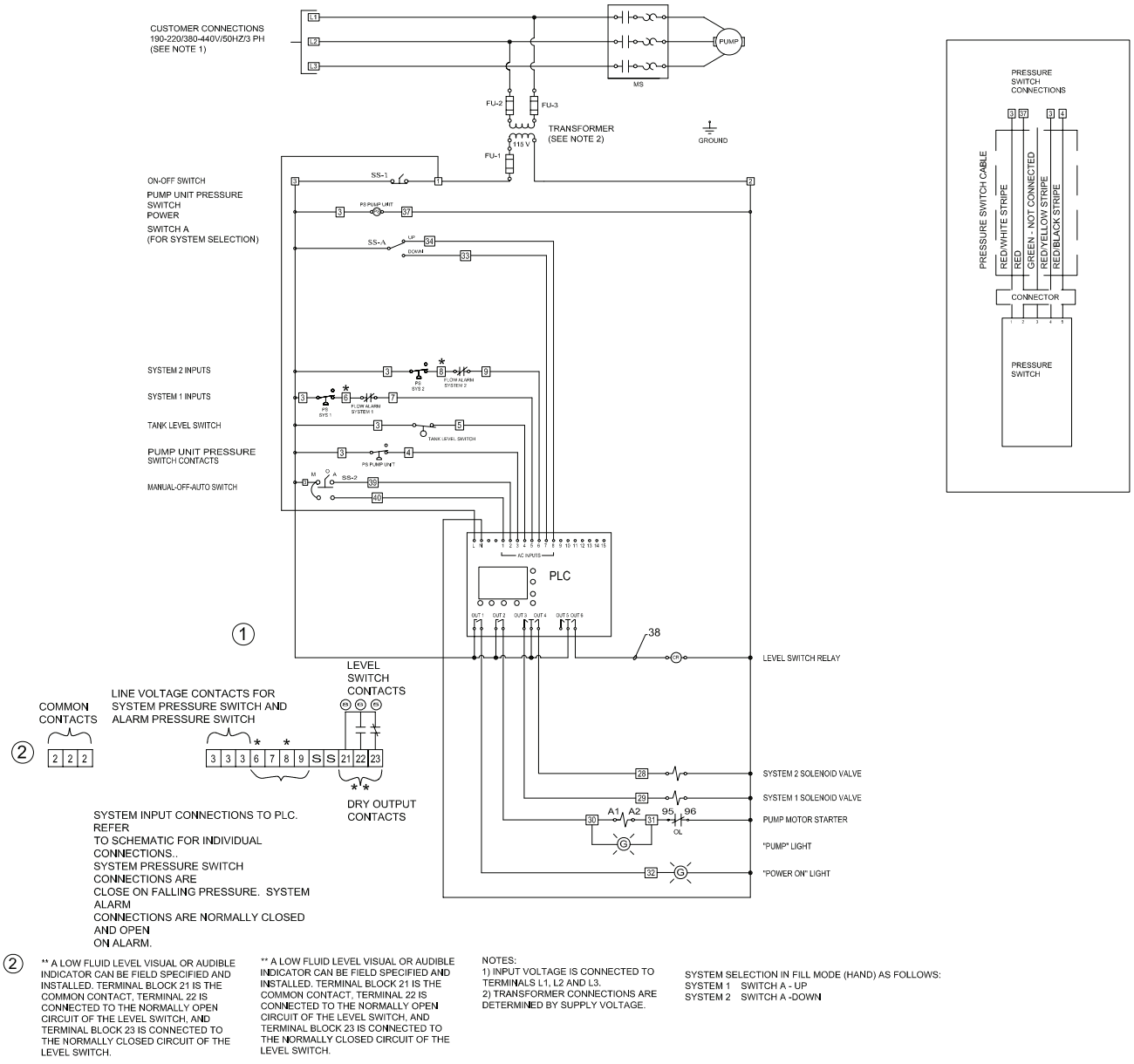

CUSTOMER CONNECTIONS
190-220/380-440V/50HZ/3 PH
(SEE NOTE 1)
L1
L2
L3
PUMP
MS
FU-2
FU-3
TRANSFORMER
(SEE NOTE 2)
GROUND
FU-1
115 V
ON-OFF SWITCH
PUMP UNIT PRESSURE SWITCH POWER
SWITCH A
(FOR SYSTEM SELECTION)
SS-1
PS PUMP UNIT
SS-A
UP
DOWN
SYSTEM 2 INPUTS
SYSTEM 1 INPUTS
TANK LEVEL SWITCH
PUMP UNIT PRESSURE SWITCH CONTACTS
MANUAL-OFF-AUTO SWITCH
SS-2
PS SYS 2
FLOW ALARM SYSTEM 2
PS SYS 1
FLOW ALARM SYSTEM 1
TANK LEVEL SWITCH
PS PUMP UNIT
AC INPUTS
PLC
OUT 1
OUT 2
OUT 3
OUT 4
OUT 5
OUT 6
38
LEVEL SWITCH RELAY
LEVEL SWITCH CONTACTS
COMMON CONTACTS
LINE VOLTAGE CONTACTS FOR SYSTEM PRESSURE SWITCH AND ALARM PRESSURE SWITCH
3 3 3 6 7 8 9 S S 21 22 23
2 2 2
DRY OUTPUT CONTACTS
SYSTEM INPUT CONNECTIONS TO PLC. REFER TO SCHEMATIC FOR INDIVIDUAL CONNECTIONS..
SYSTEM PRESSURE SWITCH CONNECTIONS ARE CLOSE ON FALLING PRESSURE. SYSTEM ALARM CONNECTIONS ARE NORMALLY CLOSED AND OPEN ON ALARM.
28
SYSTEM 2 SOLENOID VALVE
29
SYSTEM 1 SOLENOID VALVE
30
A1
A2
95
96
31
OL
PUMP MOTOR STARTER
"PUMP" LIGHT
32
"POWER ON" LIGHT
PRESSURE SWITCH CONNECTIONS
PRESSURE SWITCH CABLE
RED/WHITE STRIPE
RED
GREEN - NOT CONNECTED
RED/YELLOW STRIPE
RED/BLACK STRIPE
CONNECTOR
PRESSURE SWITCH
** A LOW FLUID LEVEL VISUAL OR AUDIBLE INDICATOR CAN BE FIELD SPECIFIED AND INSTALLED. TERMINAL BLOCK 21 IS THE COMMON CONTACT, TERMINAL 22 IS CONNECTED TO THE NORMALLY OPEN CIRCUIT OF THE LEVEL SWITCH, AND TERMINAL BLOCK 23 IS CONNECTED TO THE NORMALLY CLOSED CIRCUIT OF THE LEVEL SWITCH.
** A LOW FLUID LEVEL VISUAL OR AUDIBLE INDICATOR CAN BE FIELD SPECIFIED AND INSTALLED. TERMINAL BLOCK 21 IS THE COMMON CONTACT, TERMINAL 22 IS CONNECTED TO THE NORMALLY OPEN CIRCUIT OF THE LEVEL SWITCH, AND TERMINAL BLOCK 23 IS CONNECTED TO THE NORMALLY CLOSED CIRCUIT OF THE LEVEL SWITCH.
NOTES:
1) INPUT VOLTAGE IS CONNECTED TO TERMINALS L1, L2 AND L3.
2) TRANSFORMER CONNECTIONS ARE DETERMINED BY SUPPLY VOLTAGE.
SYSTEM SELECTION IN FILL MODE (HAND) AS FOLLOWS:
SYSTEM 1 SWITCH A - UP
SYSTEM 2 SWITCH A -DOWN

Figure 48b - Wiring Diagram 13051-2
50 Hz - 2 Solenoids

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

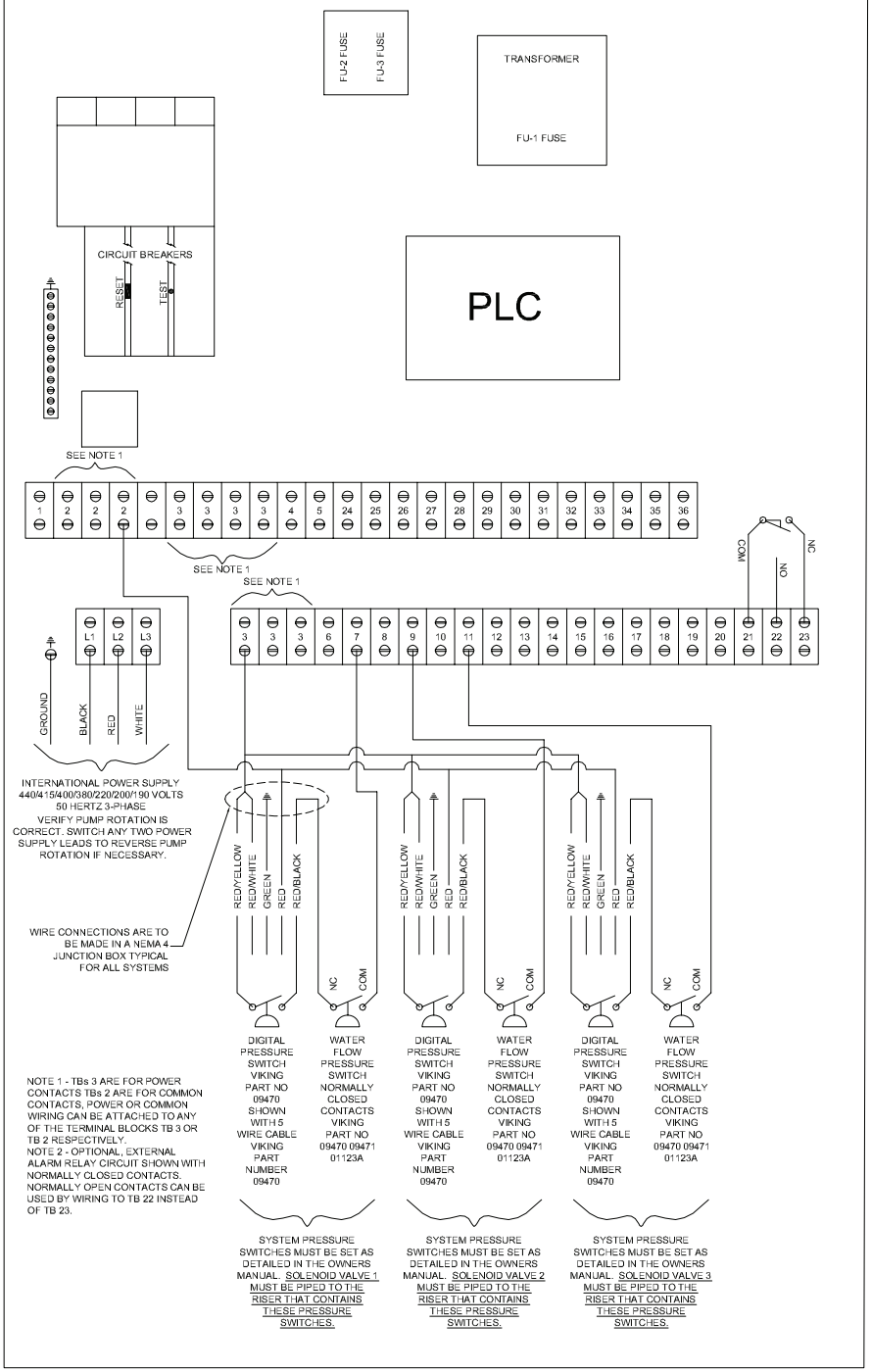

FIELD WIRING DIAGRAM
FU-2 FUSE
FU-3 FUSE
TRANSFORMER
FU-1 FUSE
CIRCUIT BREAKERS
RESET
TEST
PLC
SEE NOTE 1
SEE NOTE 1
SEE NOTE 1
COM
NO
NC
L1
L2
L3
GROUND
BLACK
RED
WHITE
INTERNATIONAL POWER SUPPLY
440/415/400/380/220/200/190 VOLTS
50 HERTZ 3-PHASE
VERIFY PUMP ROTATION IS CORRECT. SWITCH ANY TWO POWER SUPPLY LEADS TO REVERSE PUMP ROTATION IF NECESSARY.
WIRE CONNECTIONS ARE TO BE MADE IN A NEMA 4 JUNCTION BOX TYPICAL FOR ALL SYSTEMS
RED/YELLOW
RED/WHITE
GREEN
RED
RED/BLACK
NC
COM
DIGITAL PRESSURE SWITCH VIKING PART NO 09470 SHOWN WITH 5 WIRE CABLE VIKING PART NUMBER 09470
WATER FLOW PRESSURE SWITCH NORMALLY CLOSED CONTACTS VIKING PART NO 09470 09471 01123A
NOTE 1 - TBs 3 ARE FOR POWER CONTACTS TBs 2 ARE FOR COMMON CONTACTS, POWER OR COMMON WIRING CAN BE ATTACHED TO ANY OF THE TERMINAL BLOCKS TB 3 OR TB 2 RESPECTIVELY.
NOTE 2 - OPTIONAL, EXTERNAL ALARM RELAY CIRCUIT SHOWN WITH NORMALLY CLOSED CONTACTS. NORMALLY OPEN CONTACTS CAN BE USED BY WIRING TO TB 22 INSTEAD OF TB 23.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 1 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 2 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 3 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.

Figure 49a - Wiring Diagram 13051-3
50 Hz - 3 Solenoids

VIKING®

TECHNICAL DATA

ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

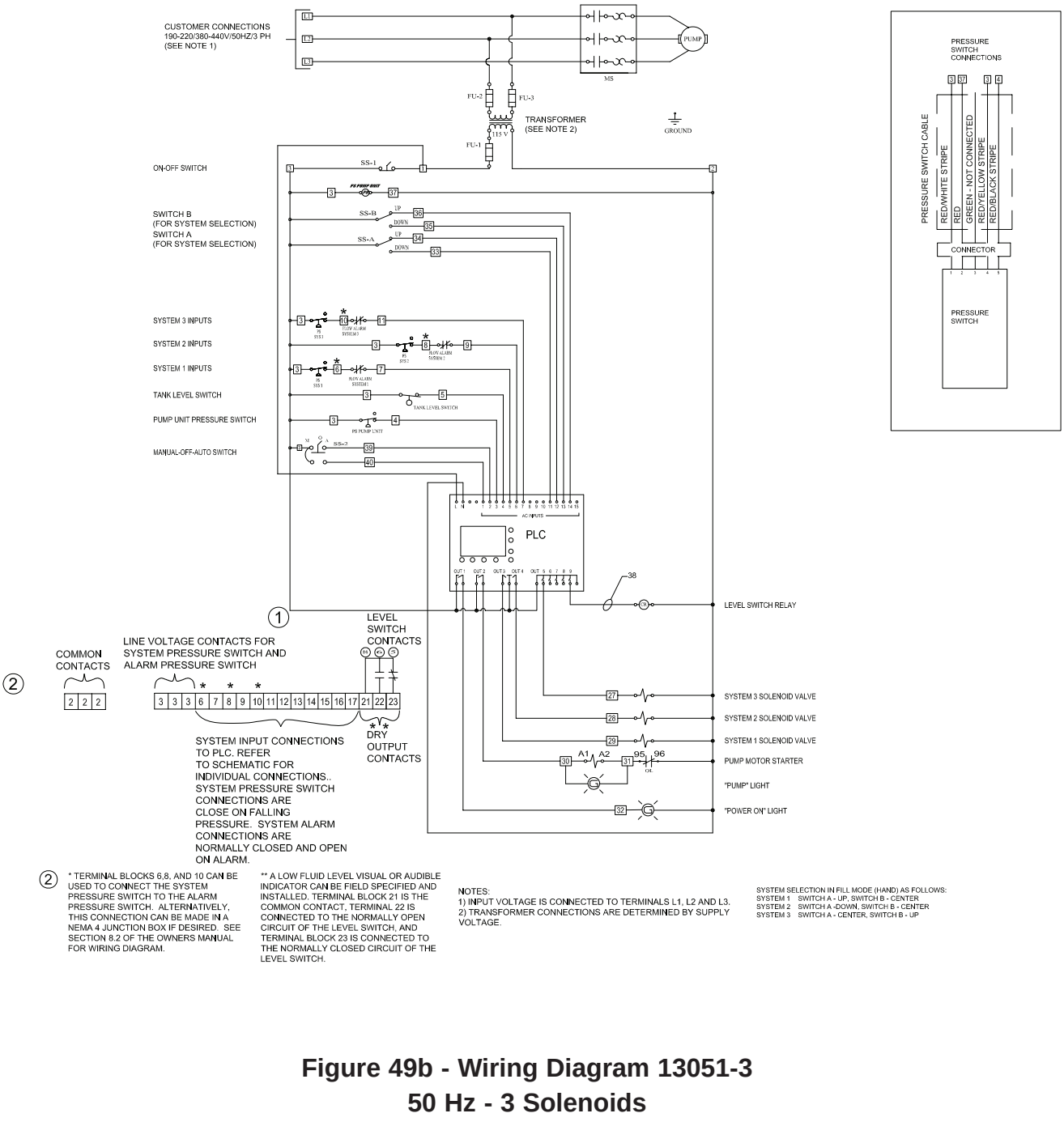

CUSTOMER CONNECTIONS
190-220/380-440V/50HZ/3 PH
(SEE NOTE 1)
L1
L2
L3
PUMP
MS
FU-2
FU-3
TRANSFORMER
(SEE NOTE 2)
115 V
FU-1
GROUND
ON-OFF SWITCH
SS-1
SWITCH B
(FOR SYSTEM SELECTION)
SWITCH A
(FOR SYSTEM SELECTION)
SS-B
SS-A
UP
DOWN
SYSTEM 3 INPUTS
SYSTEM 2 INPUTS
SYSTEM 1 INPUTS
TANK LEVEL SWITCH
PUMP UNIT PRESSURE SWITCH
MANUAL-OFF-AUTO SWITCH
SS-2
PLC
AC INPUTS
LEVEL SWITCH RELAY
LEVEL SWITCH CONTACTS
LINE VOLTAGE CONTACTS FOR SYSTEM PRESSURE SWITCH AND ALARM PRESSURE SWITCH
COMMON CONTACTS
SYSTEM INPUT CONNECTIONS TO PLC. REFER TO SCHEMATIC FOR INDIVIDUAL CONNECTIONS.. SYSTEM PRESSURE SWITCH CONNECTIONS ARE CLOSE ON FALLING PRESSURE. SYSTEM ALARM CONNECTIONS ARE NORMALLY CLOSED AND OPEN ON ALARM.
DRY OUTPUT CONTACTS
SYSTEM 3 SOLENOID VALVE
SYSTEM 2 SOLENOID VALVE
SYSTEM 1 SOLENOID VALVE
PUMP MOTOR STARTER
"PUMP" LIGHT
"POWER ON" LIGHT
PRESSURE SWITCH CONNECTIONS
PRESSURE SWITCH CABLE
RED/WHITE STRIPE
RED
GREEN - NOT CONNECTED
RED/YELLOW STRIPE
RED/BLACK STRIPE
CONNECTOR
PRESSURE SWITCH
* TERMINAL BLOCKS 6,8, AND 10 CAN BE USED TO CONNECT THE SYSTEM PRESSURE SWITCH TO THE ALARM PRESSURE SWITCH. ALTERNATIVELY, THIS CONNECTION CAN BE MADE IN A NEMA 4 JUNCTION BOX IF DESIRED. SEE SECTION 8.2 OF THE OWNERS MANUAL FOR WIRING DIAGRAM.
** A LOW FLUID LEVEL VISUAL OR AUDIBLE INDICATOR CAN BE FIELD SPECIFIED AND INSTALLED. TERMINAL BLOCK 21 IS THE COMMON CONTACT, TERMINAL 22 IS CONNECTED TO THE NORMALLY OPEN CIRCUIT OF THE LEVEL SWITCH, AND TERMINAL BLOCK 23 IS CONNECTED TO THE NORMALLY CLOSED CIRCUIT OF THE LEVEL SWITCH.
NOTES:
1) INPUT VOLTAGE IS CONNECTED TO TERMINALS L1, L2 AND L3.
2) TRANSFORMER CONNECTIONS ARE DETERMINED BY SUPPLY VOLTAGE.
SYSTEM SELECTION IN FILL MODE (HAND) AS FOLLOWS:
SYSTEM 1 SWITCH A - UP, SWITCH B - CENTER
SYSTEM 2 SWITCH A -DOWN, SWITCH B - CENTER
SYSTEM 3 SWITCH A - CENTER, SWITCH B - UP

Figure 49b - Wiring Diagram 13051-3
50 Hz - 3 Solenoids

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

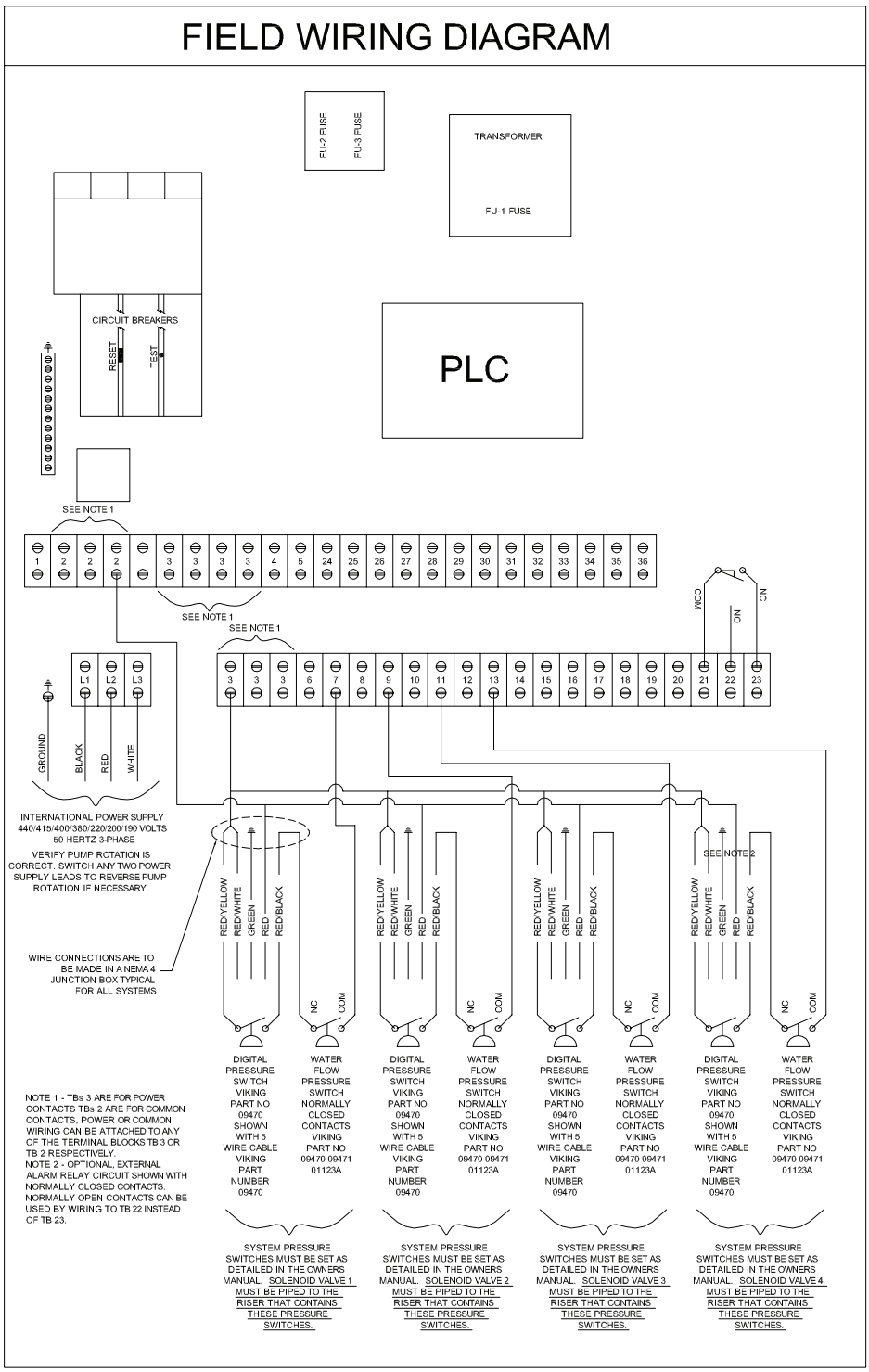

FIELD WIRING DIAGRAM
FU-2 FUSE
FU-3 FUSE
TRANSFORMER
FU-1 FUSE
CIRCUIT BREAKERS
RESET
TEST
PLC
SEE NOTE 1
SEE NOTE 1
SEE NOTE 1
COM
NO
NC
L1
L2
L3
GROUND
BLACK
RED
WHITE
INTERNATIONAL POWER SUPPLY
440/415/400/380/220/200/190 VOLTS
50 HERTZ 3-PHASE
VERIFY PUMP ROTATION IS CORRECT, SWITCH ANY TWO POWER SUPPLY LEADS TO REVERSE PUMP ROTATION IF NECESSARY.
WIRE CONNECTIONS ARE TO BE MADE IN A NEMA 4 JUNCTION BOX TYPICAL FOR ALL SYSTEMS
SEE NOTE 2
RED/YELLOW
RED/WHITE
GREEN
RED
RED/BLACK
NC
COM
DIGITAL PRESSURE SWITCH VIKING PART NO 09470 SHOWN WITH 5 WIRE CABLE VIKING PART NUMBER 09470
WATER FLOW PRESSURE SWITCH NORMALLY CLOSED CONTACTS VIKING PART NO 09470 09471 01123A
NOTE 1 - TBs 3 ARE FOR POWER CONTACTS TBs 2 ARE FOR COMMON CONTACTS, POWER OR COMMON WIRING CAN BE ATTACHED TO ANY OF THE TERMINAL BLOCKS TB 3 OR TB 2 RESPECTIVELY.
NOTE 2 - OPTIONAL, EXTERNAL ALARM RELAY CIRCUIT SHOWN WITH NORMALLY CLOSED CONTACTS. NORMALLY OPEN CONTACTS CAN BE USED BY WIRING TO TB 22 INSTEAD OF TB 23.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 1 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 2 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 3 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 4 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.

Figure 50a - Wiring Diagram 13051-4
50 Hz - 4 Solenoids

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

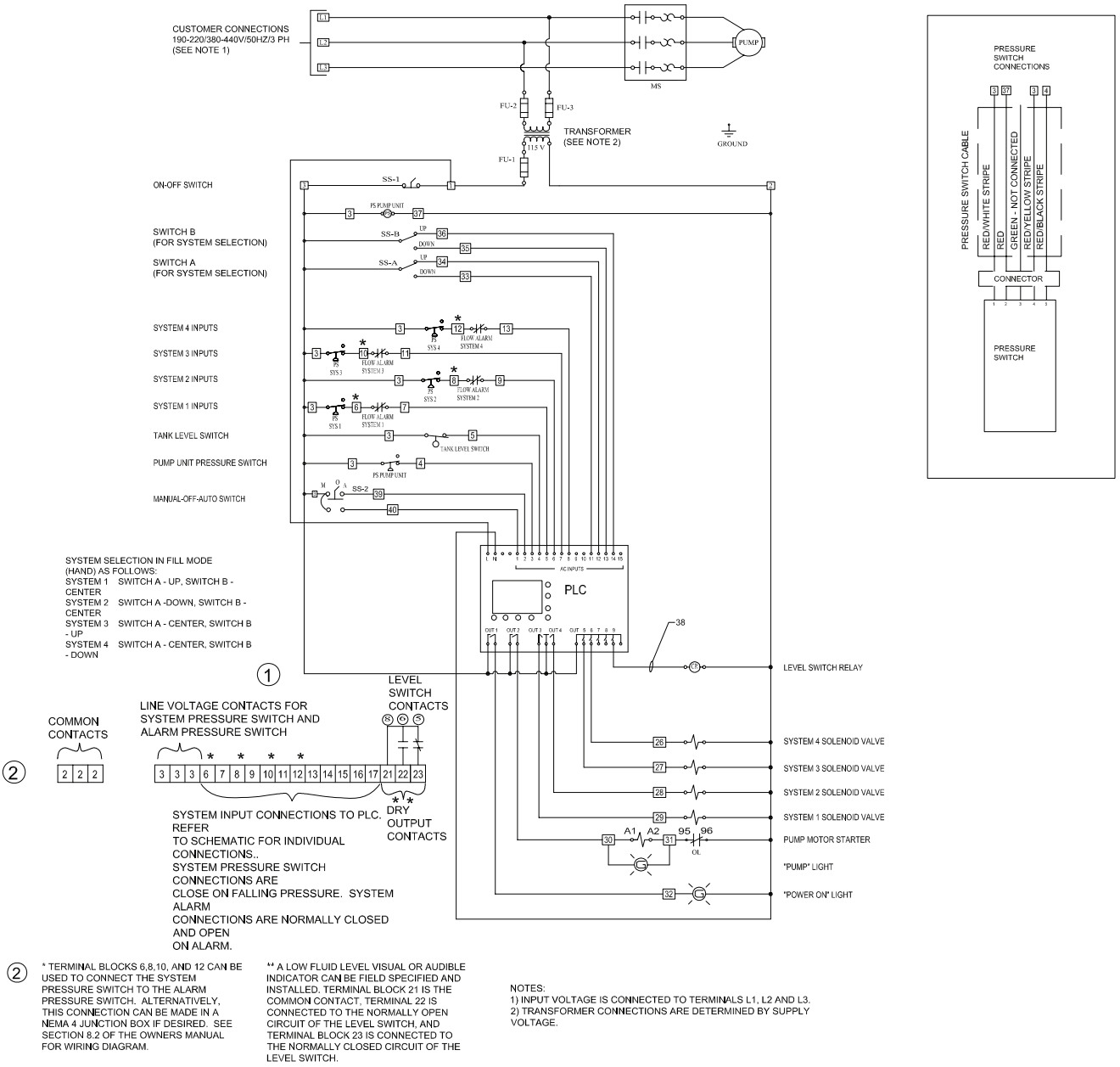

CUSTOMER CONNECTIONS
190-220/380-440V/50HZ/3 PH
(SEE NOTE 1)
L1
L2
L3
PUMP
MS
FU-2
FU-3
FU-1
TRANSFORMER
(SEE NOTE 2)
115 V
GROUND
ON-OFF SWITCH
SS-1
PS PUMP UNIT
SWITCH B
(FOR SYSTEM SELECTION)
SS-B
UP
DOWN
SWITCH A
(FOR SYSTEM SELECTION)
SS-A
SYSTEM 4 INPUTS
SYSTEM 3 INPUTS
SYSTEM 2 INPUTS
SYSTEM 1 INPUTS
TANK LEVEL SWITCH
PUMP UNIT PRESSURE SWITCH
MANUAL-OFF-AUTO SWITCH
SS-2
FLOW ALARM SYSTEM 4
FLOW ALARM SYSTEM 3
FLOW ALARM SYSTEM 2
FLOW ALARM SYSTEM 1
SYS 4
SYS 3
SYS 2
SYS 1
TANK LEVEL SWITCH
PS PUMP UNIT
SYSTEM SELECTION IN FILL MODE
(HAND) AS FOLLOWS:
SYSTEM 1 SWITCH A - UP, SWITCH B - CENTER
SYSTEM 2 SWITCH A -DOWN, SWITCH B - CENTER
SYSTEM 3 SWITCH A - CENTER, SWITCH B - UP
SYSTEM 4 SWITCH A - CENTER, SWITCH B - DOWN
PLC
AC INPUTS
LEVEL SWITCH RELAY
LEVEL SWITCH CONTACTS
LINE VOLTAGE CONTACTS FOR SYSTEM PRESSURE SWITCH AND ALARM PRESSURE SWITCH
COMMON CONTACTS
SYSTEM INPUT CONNECTIONS TO PLC. REFER TO SCHEMATIC FOR INDIVIDUAL CONNECTIONS..
SYSTEM PRESSURE SWITCH CONNECTIONS ARE CLOSE ON FALLING PRESSURE. SYSTEM ALARM CONNECTIONS ARE NORMALLY CLOSED AND OPEN ON ALARM.
DRY OUTPUT CONTACTS
SYSTEM 4 SOLENOID VALVE
SYSTEM 3 SOLENOID VALVE
SYSTEM 2 SOLENOID VALVE
SYSTEM 1 SOLENOID VALVE
PUMP MOTOR STARTER
OL
"PUMP" LIGHT
"POWER ON" LIGHT
PRESSURE SWITCH CONNECTIONS
PRESSURE SWITCH CABLE
RED/WHITE STRIPE
RED
GREEN - NOT CONNECTED
RED/YELLOW STRIPE
RED/BLACK STRIPE
CONNECTOR
PRESSURE SWITCH
* TERMINAL BLOCKS 6,8,10, AND 12 CAN BE USED TO CONNECT THE SYSTEM PRESSURE SWITCH TO THE ALARM PRESSURE SWITCH. ALTERNATIVELY, THIS CONNECTION CAN BE MADE IN A NEMA 4 JUNCTION BOX IF DESIRED. SEE SECTION 8.2 OF THE OWNERS MANUAL FOR WIRING DIAGRAM.
** A LOW FLUID LEVEL VISUAL OR AUDIBLE INDICATOR CAN BE FIELD SPECIFIED AND INSTALLED. TERMINAL BLOCK 21 IS THE COMMON CONTACT, TERMINAL 22 IS CONNECTED TO THE NORMALLY OPEN CIRCUIT OF THE LEVEL SWITCH, AND TERMINAL BLOCK 23 IS CONNECTED TO THE NORMALLY CLOSED CIRCUIT OF THE LEVEL SWITCH.
NOTES:
1) INPUT VOLTAGE IS CONNECTED TO TERMINALS L1, L2 AND L3.
2) TRANSFORMER CONNECTIONS ARE DETERMINED BY SUPPLY VOLTAGE.

Figure 50b - Wiring Diagram 13051-4
50 Hz - 4 Solenoids

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

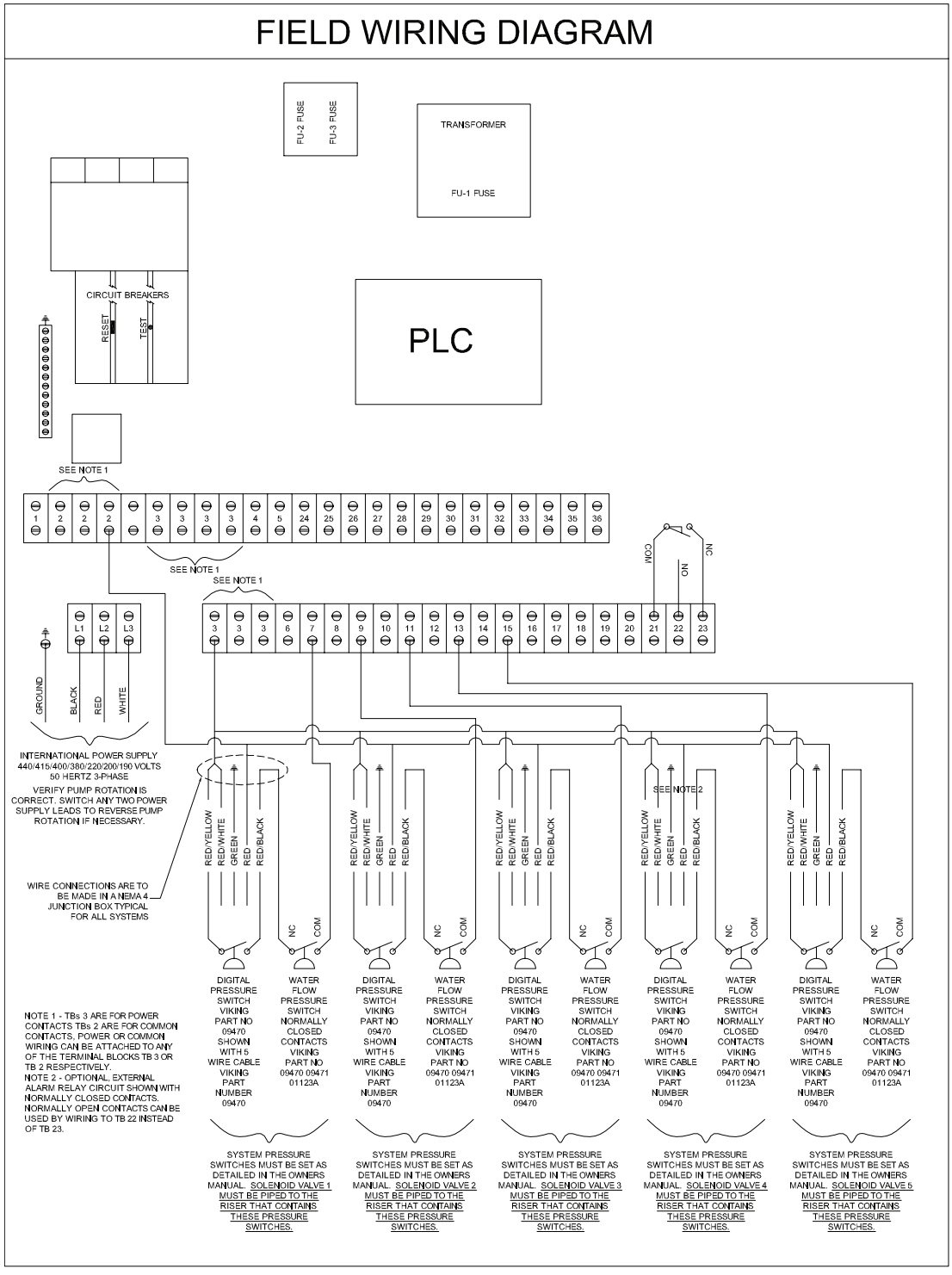

FIELD WIRING DIAGRAM
FU-2 FUSE
FU-3 FUSE
TRANSFORMER
FU-1 FUSE
CIRCUIT BREAKERS
RESET
TEST
PLC
SEE NOTE 1
COM
NO
NC
L1
L2
L3
GROUND
BLACK
RED
WHITE
INTERNATIONAL POWER SUPPLY
440/415/400/380/220/200/190 VOLTS
50 HERTZ 3-PHASE
VERIFY PUMP ROTATION IS CORRECT. SWITCH ANY TWO POWER SUPPLY LEADS TO REVERSE PUMP ROTATION IF NECESSARY.
WIRE CONNECTIONS ARE TO BE MADE IN A NEMA 4 JUNCTION BOX TYPICAL FOR ALL SYSTEMS
SEE NOTE2
RED/YELLOW
RED/WHITE
GREEN
RED
RED/BLACK
NC
COM
DIGITAL PRESSURE SWITCH VIKING PART NO 09470 SHOWN WITH 5 WIRE CABLE VIKING PART NUMBER 09470
WATER FLOW PRESSURE SWITCH NORMALLY CLOSED CONTACTS VIKING PART NO 09470 09471 01123A
NOTE 1 - TBs 3 ARE FOR POWER CONTACTS TBs 2 ARE FOR COMMON CONTACTS, POWER OR COMMON WIRING CAN BE ATTACHED TO ANY OF THE TERMINAL BLOCKS TB 3 OR TB 2 RESPECTIVELY.
NOTE 2 - OPTIONAL, EXTERNAL ALARM RELAY CIRCUIT SHOWN WITH NORMALLY CLOSED CONTACTS. NORMALLY OPEN CONTACTS CAN BE USED BY WIRING TO TB 22 INSTEAD OF TB 23.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 1 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 2 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 3 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 4 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 5 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.

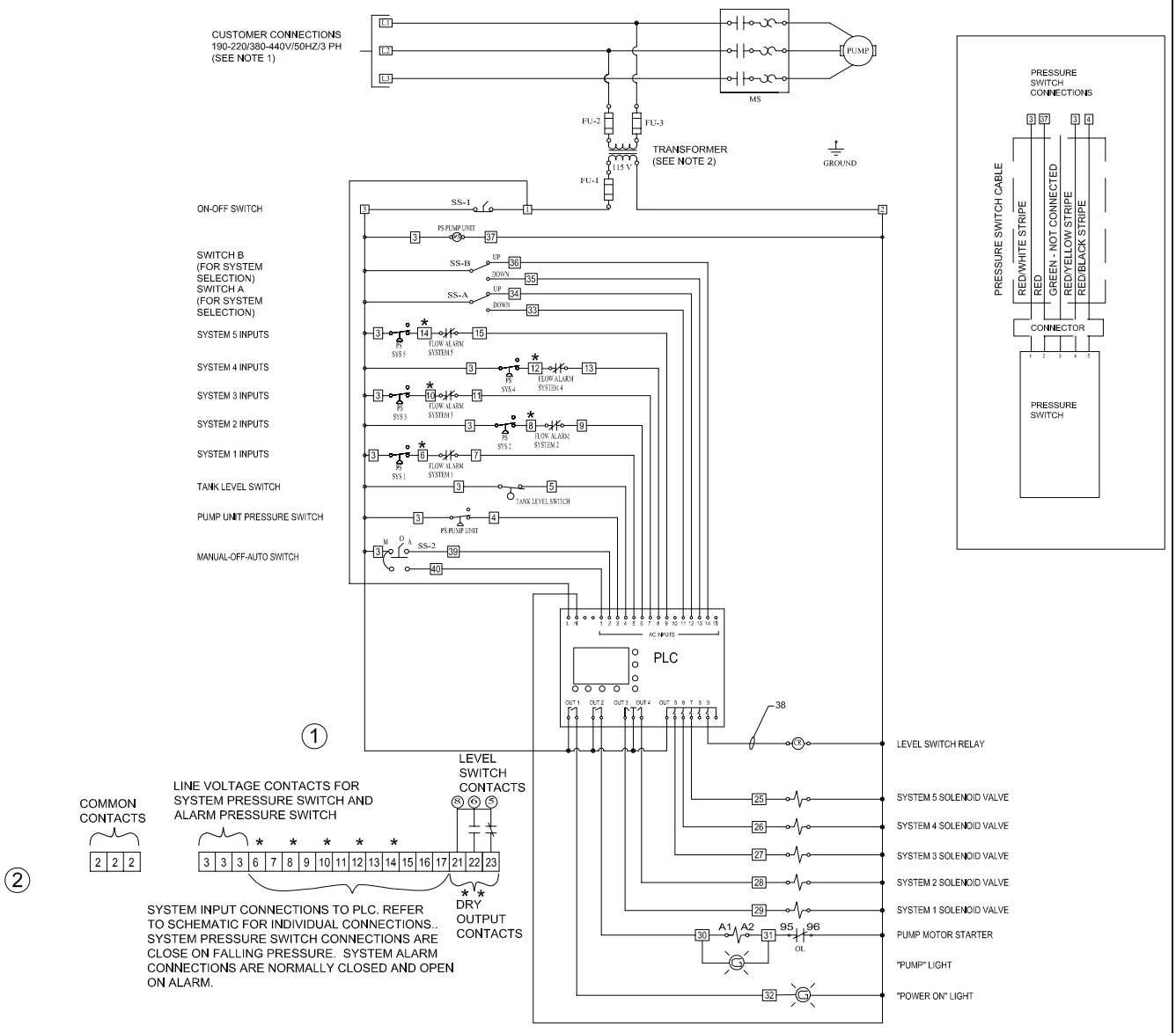
Figure 51a - Wiring Diagram 13051-5
50 Hz - 5 Solenoids

VIKING®

TECHNICAL DATA

ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



② * TERMINAL BLOCKS 6,8,10, 12, AND 14 CAN BE USED TO CONNECT THE SYSTEM PRESSURE SWITCH TO THE ALARM PRESSURE SWITCH. ALTERNATIVELY, THIS CONNECTION CAN BE MADE IN A NEMA 4 JUNCTION BOX IF DESIRED. SEE SECTION 8.2 OF THE OWNERS MANUAL FOR WIRING DIAGRAM.

** A LOW FLUID LEVEL VISUAL OR AUDIBLE INDICATOR CAN BE FIELD SPECIFIED AND INSTALLED. TERMINAL BLOCK 21 IS THE COMMON CONTACT, TERMINAL 22 IS CONNECTED TO THE NORMALLY OPEN CIRCUIT OF THE LEVEL SWITCH, AND TERMINAL BLOCK 23 IS CONNECTED TO THE NORMALLY CLOSED CIRCUIT OF THE LEVEL SWITCH.

NOTES:
1) INPUT VOLTAGE IS CONNECTED TO TERMINALS L1, L2 AND L3.
2) TRANSFORMER CONNECTIONS ARE DETERMINED BY SUPPLY VOLTAGE.

SYSTEM SELECTION IN FILL MODE (HAND) AS FOLLOWS:
SYSTEM 1 SWITCH A - UP, SWITCH B - CENTER
SYSTEM 2 SWITCH A -DOWN, SWITCH B - CENTER
SYSTEM 3 SWITCH A - CENTER, SWITCH B - UP
SYSTEM 4 SWITCH A - CENTER, SWITCH B - DOWN
SYSTEM 5 SWITCH A - UP, SWITCH B - UP
SYSTEM 6 SWITCH A - DOWN, SWITCH B - DOWN (N/A)

Figure 51b - Wiring Diagram 13051-5
50 Hz - 5 Solenoids

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

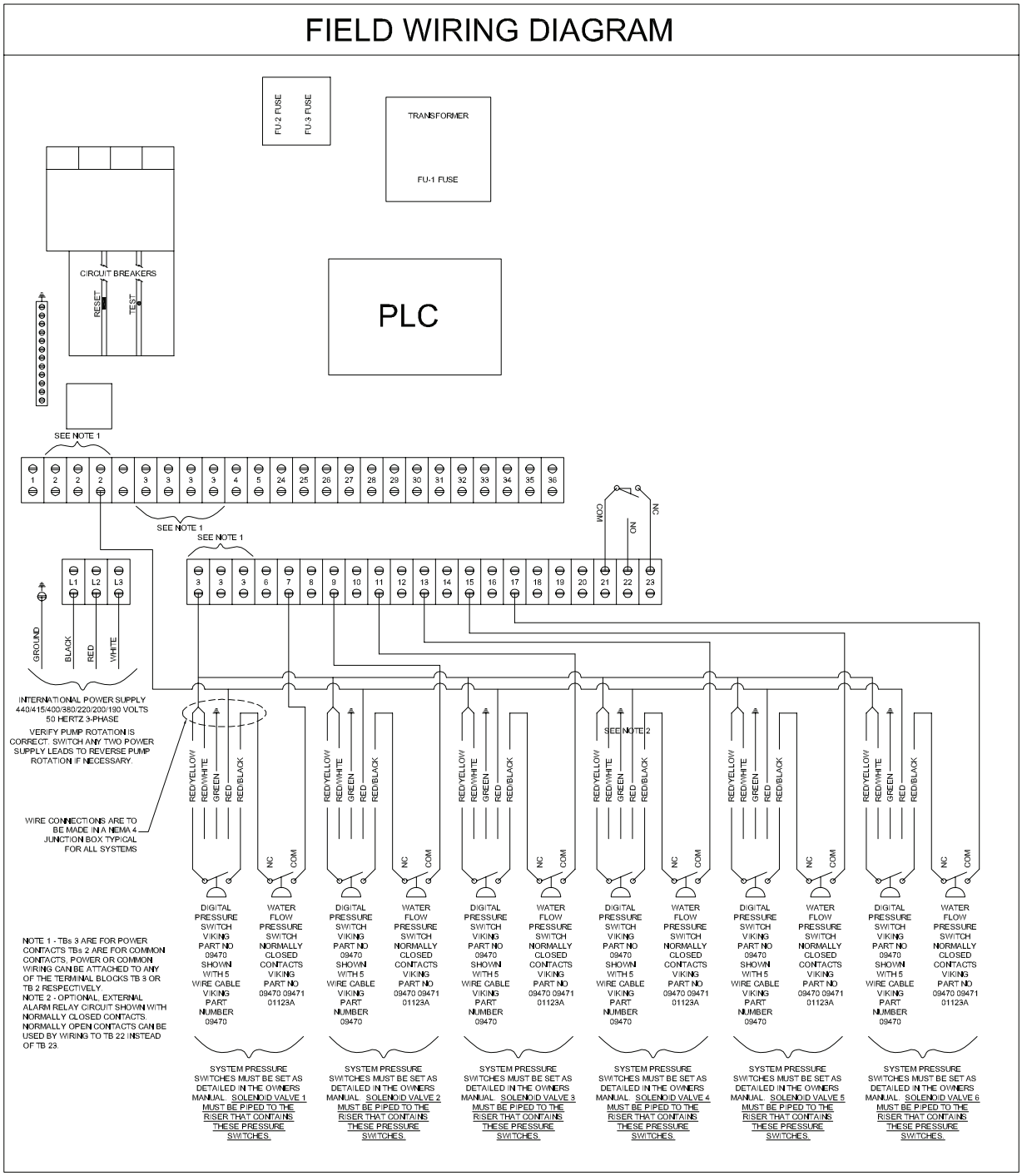
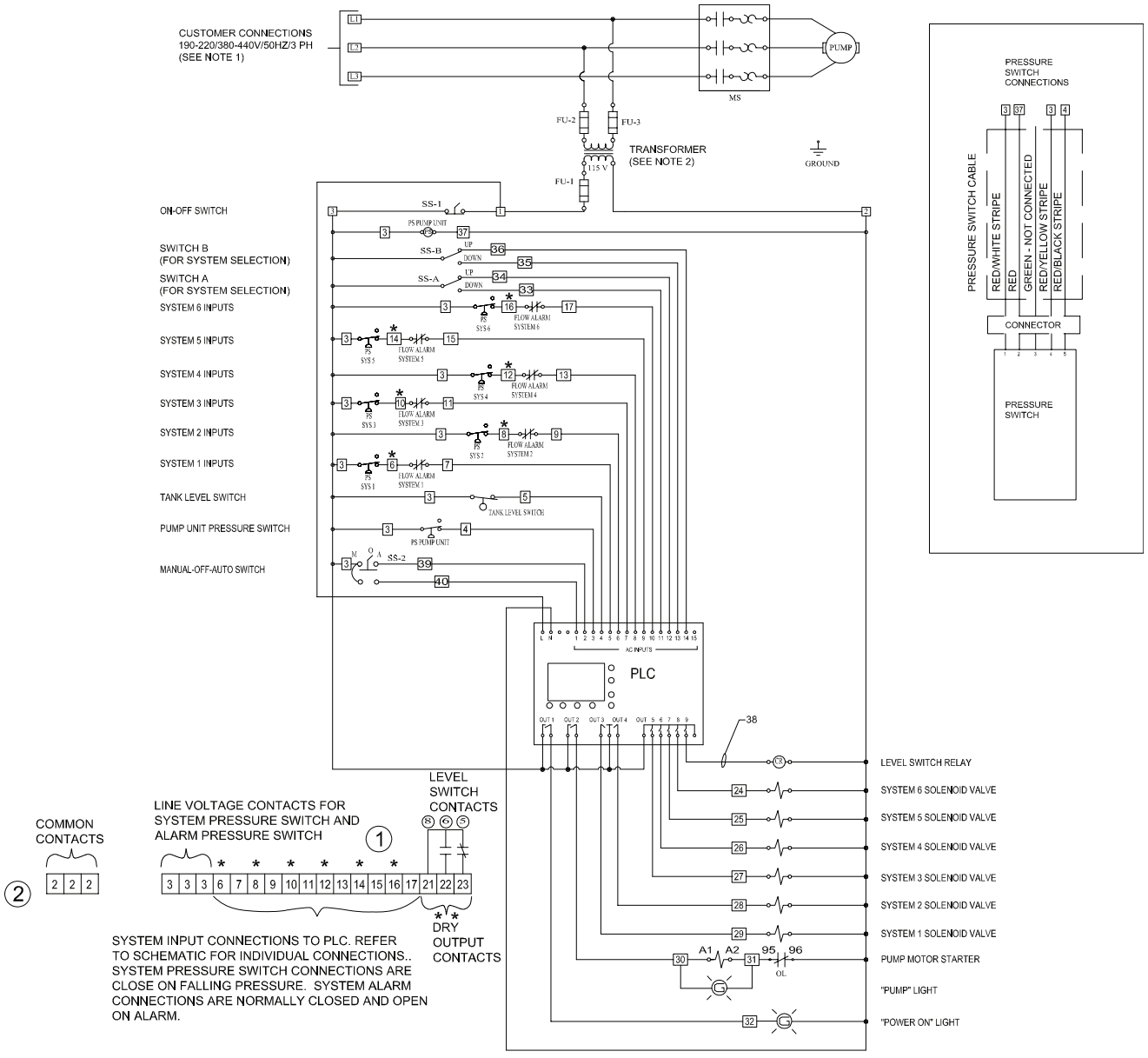

FIELD WIRING DIAGRAM
FU-2 FUSE
FU-3 FUSE
TRANSFORMER
FU-1 FUSE
CIRCUIT BREAKERS
RESET
TEST
PLC
SEE NOTE 1
SEE NOTE 1
SEE NOTE 1
COM
NO
GROUND
BLACK
RED
WHITE
INTERNATIONAL POWER SUPPLY
440/415/400/380/220/200/190 VOLTS
50 HERTZ 3-PHASE
VERIFY PUMP ROTATION IS CORRECT. SWITCH ANY TWO POWER SUPPLY LEADS TO REVERSE PUMP ROTATION IF NECESSARY.
WIRE CONNECTIONS ARE TO BE MADE IN A NEMA 4 JUNCTION BOX TYPICAL FOR ALL SYSTEMS
SEE NOTE 2
RED/YELLOW
RED/WHITE
GREEN
RED
RED/BLACK
NC
COM
DIGITAL PRESSURE SWITCH VIKING PART NO 09470 SHOWN WITH 5 WIRE CABLE VIKING PART NUMBER 09470
WATER FLOW PRESSURE SWITCH NORMALLY CLOSED CONTACTS VIKING PART NO 09470 09471 01123A
NOTE 1 - TBs 3 ARE FOR POWER CONTACTS TBs 2 ARE FOR COMMON CONTACTS. POWER OR COMMON WIRING CAN BE ATTACHED TO ANY OF THE TERMINAL BLOCKS TB 3 OR TB 2 RESPECTIVELY.
NOTE 2 - OPTIONAL. EXTERNAL ALARM RELAY CIRCUIT SHOWN WITH NORMALLY CLOSED CONTACTS. NORMALLY OPEN CONTACTS CAN BE USED BY WIRING TO TB 22 INSTEAD OF TB 23.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 1 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 2 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 3 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 4 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 5 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.
SYSTEM PRESSURE SWITCHES MUST BE SET AS DETAILED IN THE OWNERS MANUAL. SOLENOID VALVE 6 MUST BE PIPED TO THE RISER THAT CONTAINS THESE PRESSURE SWITCHES.

Figure 52a - Wiring Diagram 13051-6
50 Hz - 6 Solenoids

TECHNICAL DATA

ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



(2) * TERMINAL BLOCKS 6,8,10, 12, 14, AND 16 CAN BE USED TO CONNECT THE SYSTEM PRESSURE SWITCH TO THE ALARM PRESSURE SWITCH. ALTERNATIVELY, THIS CONNECTION CAN BE MADE IN A NEMA 4 JUNCTION BOX IF DESIRED. SEE SECTION 8.2 OF THE OWNERS MANUAL FOR WIRING DIAGRAM.

** A LOW FLUID LEVEL VISUAL OR AUDIBLE INDICATOR CAN BE FIELD SPECIFIED AND INSTALLED. TERMINAL BLOCK 21 IS THE COMMON CONTACT, TERMINAL 22 IS CONNECTED TO THE NORMALLY OPEN CIRCUIT OF THE LEVEL SWITCH, AND TERMINAL BLOCK 23 IS CONNECTED TO THE NORMALLY CLOSED CIRCUIT OF THE LEVEL SWITCH.

NOTES:
1) INPUT VOLTAGE IS CONNECTED TO TERMINALS L1, L2 AND L3.
2) TRANSFORMER CONNECTIONS ARE DETERMINED BY SUPPLY VOLTAGE.

SYSTEM SELECTION IN FILL MODE (HAND) AS FOLLOWS:
SYSTEM 1 SWITCH A - UP, SWITCH B - CENTER
SYSTEM 2 SWITCH A -DOWN, SWITCH B - CENTER
SYSTEM 3 SWITCH A - CENTER, SWITCH B - UP
SYSTEM 4 SWITCH A - CENTER, SWITCH B - DOWN
SYSTEM 5 SWITCH A - UP, SWITCH B - UP
SYSTEM 6 SWITCH A - DOWN, SWITCH B - DOWN

Figure 52b - Wiring Diagram 13051-6
50 Hz - 6 Solenoids

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

4. Wiring Circuit 4

See pages 86-89.

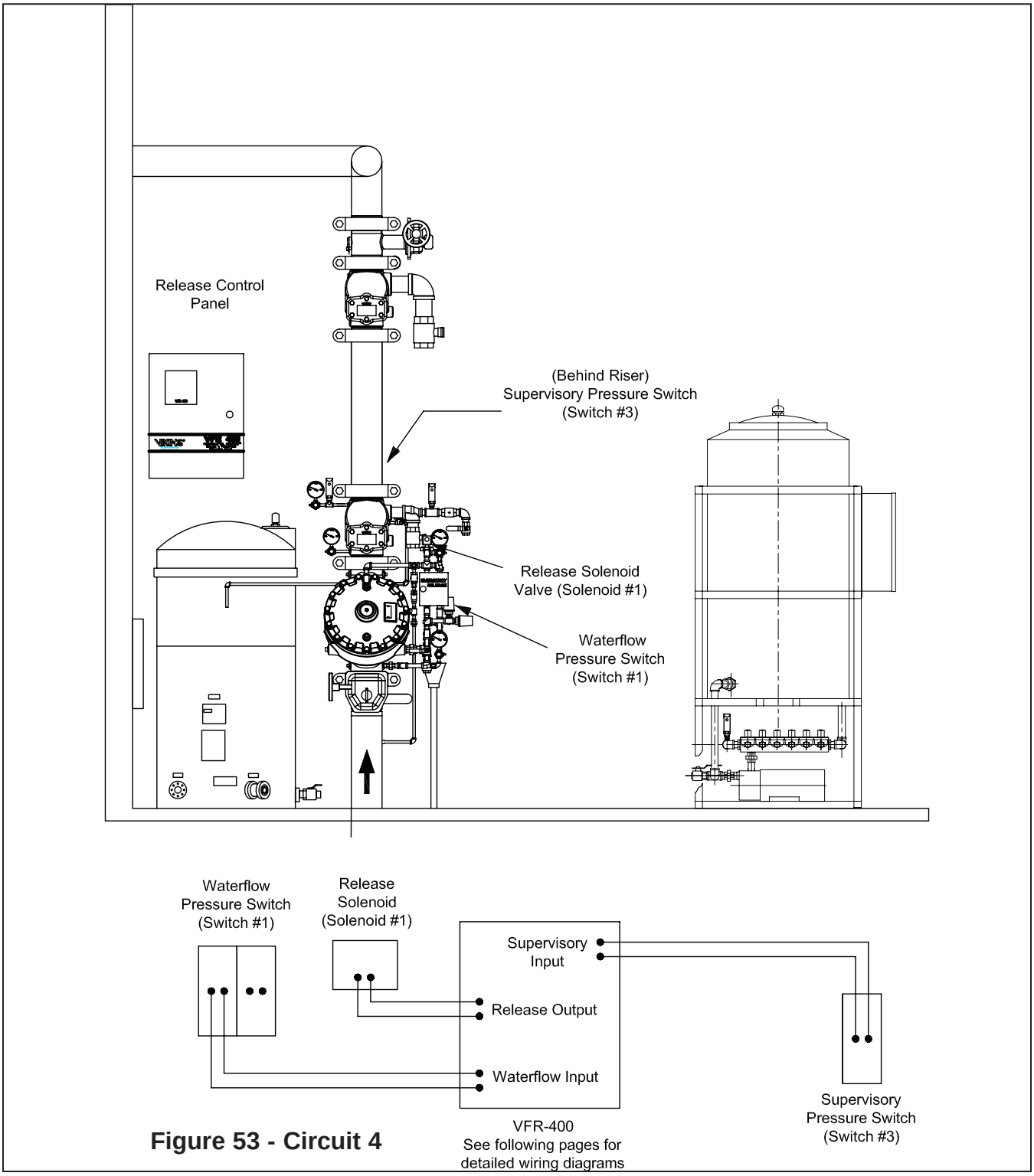

Release Control Panel
(Behind Riser) Supervisory Pressure Switch (Switch #3)
Release Solenoid Valve (Solenoid #1)
Waterflow Pressure Switch (Switch #1)
Waterflow Pressure Switch (Switch #1)
Release Solenoid (Solenoid #1)
Supervisory Input
Release Output
Waterflow Input
VFR-400
See following pages for detailed wiring diagrams
Supervisory Pressure Switch (Switch #3)

Figure 53 - Circuit 4

VIKING®

TECHNICAL DATA

ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

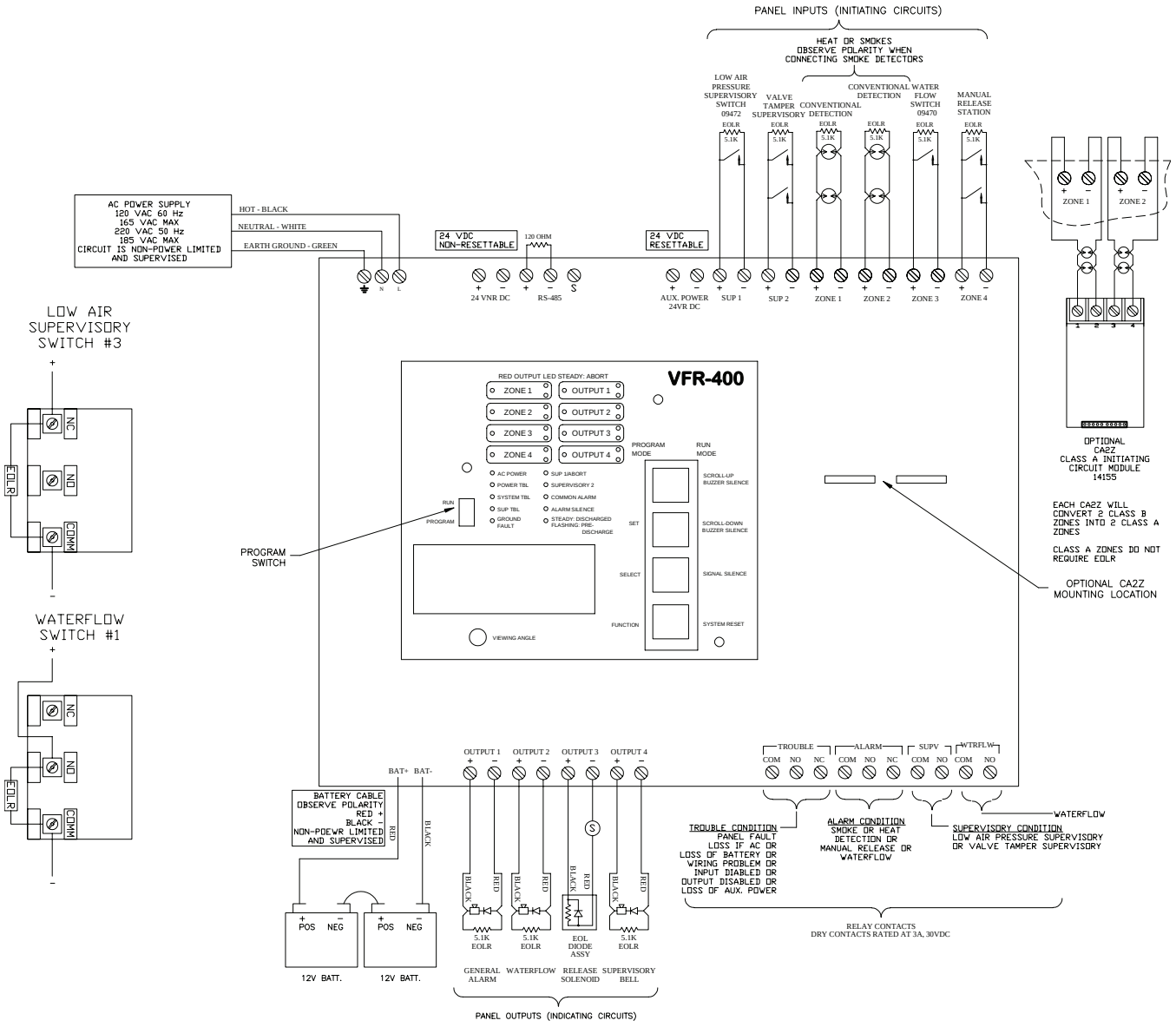
PROGRAM #1						
For One Sprinkler System						
Viking Sprinkler System Types	2 Release Zones, Waterflow Zone, & Manual Release Zone	1. Single Interlocked Preaction System with Electric Release				
		2. Deluge System with Electric Release				
		3. Non-Interlocked Preaction System with Electric Release				
		4. Double Interlocked Preaction System with Electric/Pnuematic Release				
OUTPUTS (Indicating Circuits)	ZONES (Initiating Circuits)					
	SUP 1	SUP 2	#1	#2	#3	#4
	Low Air Supervisory Zone	**Valve Tamper Supervisory Zone**	**Conventional Detection Zone**	**Conventional Detection Zone**	**Waterflow Zone**	**Manual Release Zone**
#1 General Alarm			X	X	X	X
#2 Waterflow					X	
#3 Release Solenoid			X	X		X
#4 Supervisory Bell	X	X				

OPERATION DESCRIPTION	
Inputs:	2 Conventional Detection zones, 1 Waterflow zone, 1 Manual Release zone, 2 Supervisory zones
Outputs:	1 General Alarm, 1 Waterflow Alarm, 1 Solenoid Release, 1 Supervisory Bell
Operation:	Activation of Conventional Detection zone #1 or #2 or Manual Release zone #4 will activate output #3 (Release Solenoid) and output #1 (General Alarm)
	Activation of Waterflow zone #3 will activate output #2 (Waterflow) and output #1 (General Alarm)
	Activation of Low Air Supervisory zone #1 or Valve Tamper Supervisory zone #2 will operate output #4 (Supervisory Bell).

NOTES:

1. Connect EOL Diode assembly IN SERIES as shown with Solenoid on output #3 (Release Solenoid). Black wire to positive terminal on panel and Red wire through Solenoid to negative terminal on panel.
2. Polarity is shown on indicating circuits in normal (no alarm) condition. Polarity reverses when output is activated.
3. Leave EOLR (provided) on all unused circuits.
4. See the instruction manual for circuit information, panel limits, and batery sizing.
5. For wire routing instructions through the releasing panel, see Note 3 on page 59 of the instruction manual.
6. See instruction manual for proper programming.
7. See instruction manual for list of compatible smoke detectors.
8. See specific system type data page for proper pressure switch settings.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



VFR400 PROGRAM #1

Figure 54 - Wiring Diagram for VFR-400

VIKING®

TECHNICAL DATA

ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

PROGRAM #5

For One Sprinkler System - NYC Special

Viking Sprinkler System Types	Release Zone and Manual Release Zone	1. Single Interlocked Preaction with Electric Release
		2. Deluge System with Electric Release
		2. Non-Interlocked Preaction with Electric Release
		3. Double Interlocked Preaction with Electric/Pneumatic Release

OUTPUTS (Indicating Circuits)	ZONES (Initiating Circuits)					
	SUP 1	SUP 2	#1	#2	#3	#4
	Valve Tamper Supervisory Zone	**Low Air Supervisory Zone**	**Conventional Detection Zone**	**Low Air Alarm Zone**	**Waterflow Zone**	**Manual Release Zone**
#1 General Alarm			X		X	X
#2 Supervisory Bell	X	X		X		
#3 Release Solenoid			X			X
#4 Trouble Bell						

OPERATION DESCRIPTION

Inputs:	1 Conventional Detection zone, 1 Waterflow zone, 1 Low Air Alarm zone, 1 Manual Release zone, 2 Supervisory zones
Outputs:	1 General Alarm, 1 Trouble Bell, 1 Release Solenoid, 1 Supervisory Bell
Operation:	Activation of Conventional Detection zone #1 or Manual Release Zone #4 will activate output #3 (Release Solenoid) and output #1 (General Alarm).
	Activation of Waterflow zone #3 will activate output #1 (General Alarm).
	Activation of Low Air Alarm Zone or Low Air Supervisory Zone or Valve Tamper Supervisory Zone will activate output #2 (Supervisory Bell).
	A trouble condition, (low battery, wire short in outputs, loss AC, Panel problem) will activate output #4 (Trouble Bell) and trouble relay.

NOTES:

1. Connect EOL Diode assembly IN SERIES as shown with Solenoid on output #3 (Release Solenoid). Black wire to positive terminal on panel and Red wire through Solenoid to negative terminal on panel.
2. Polarity is shown on indicating circuits in normal (no alarm) condition. Polarity reverses when output is activated.
3. Leave EOLR (provided) on all unused circuits.
4. See the instruction manual for circuit information, panel limits, and batery sizing.
5. For wire routing instructions through the releasing panel, see Note 3 on page 59 of the instruction manual.
6. See instruction manual for proper programming.
7. See instruction manual for list of compatible smoke detectors.
8. See specific system type data page for proper pressure switch settings.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

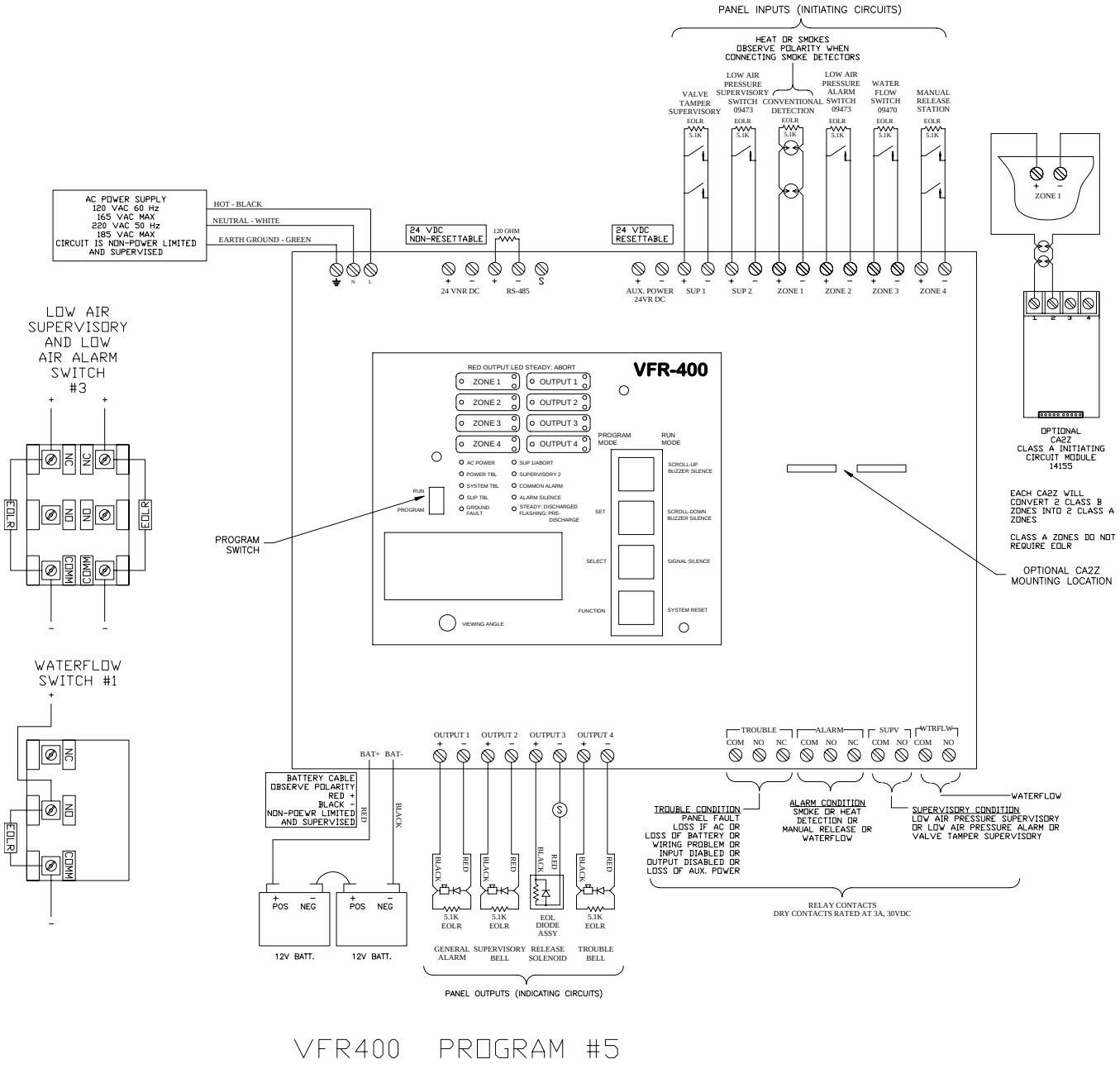
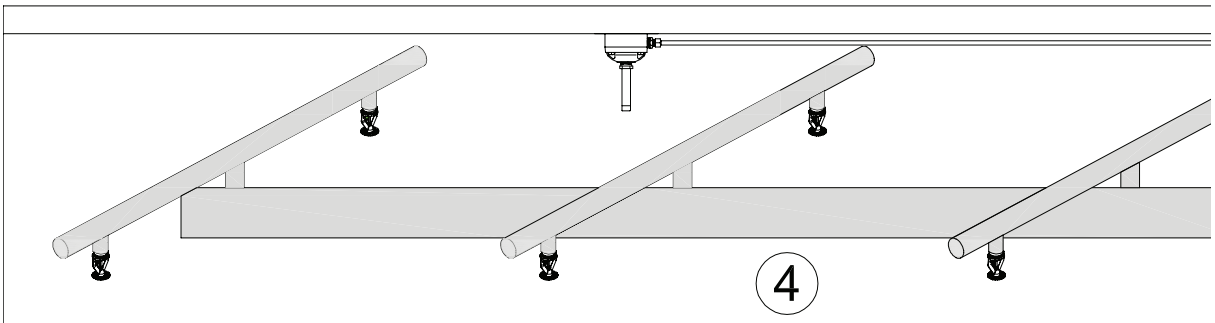


Figure 55 - Wiring Diagram for VFR-400
Special NYC

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

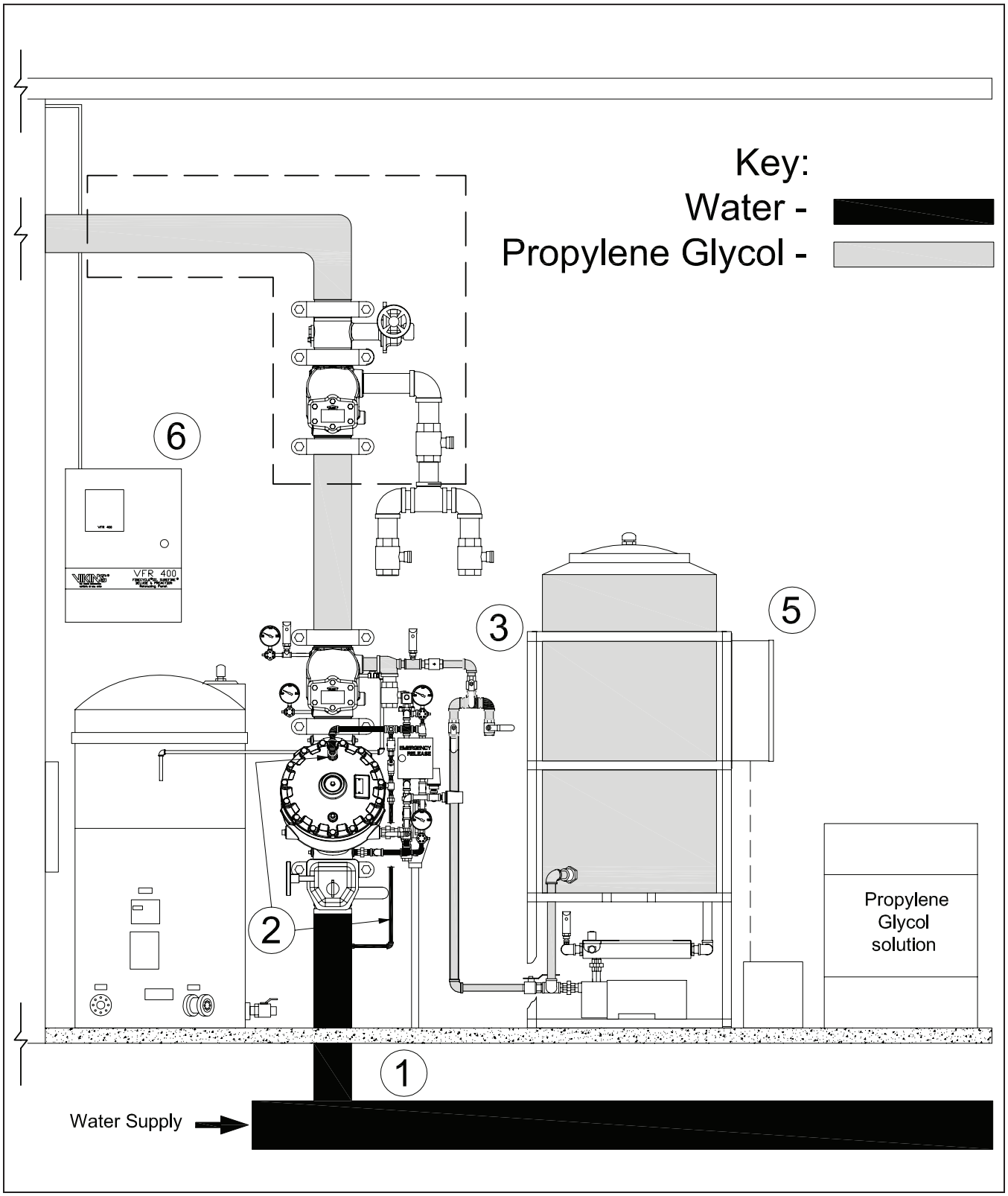


V. SYSTEM OPERATION

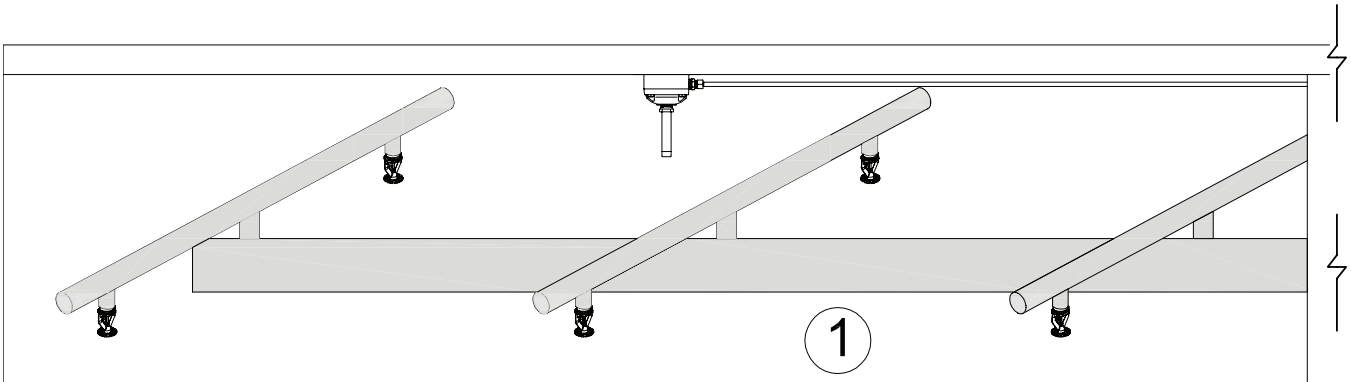
Normal Condition:

1. Water supply is at normal system pressure.
2. Water travels through the prime line, into the priming chamber of the deluge valve, holding the valve closed.
3. CS-1 tank is full of propylene glycol solution.
4. The system piping is primed with 50 psi of propylene glycol solution.
5. The CS-1 tank and pump assembly is in the normal power condition.
6. The VFR-400 release control panel is in the normal power condition.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



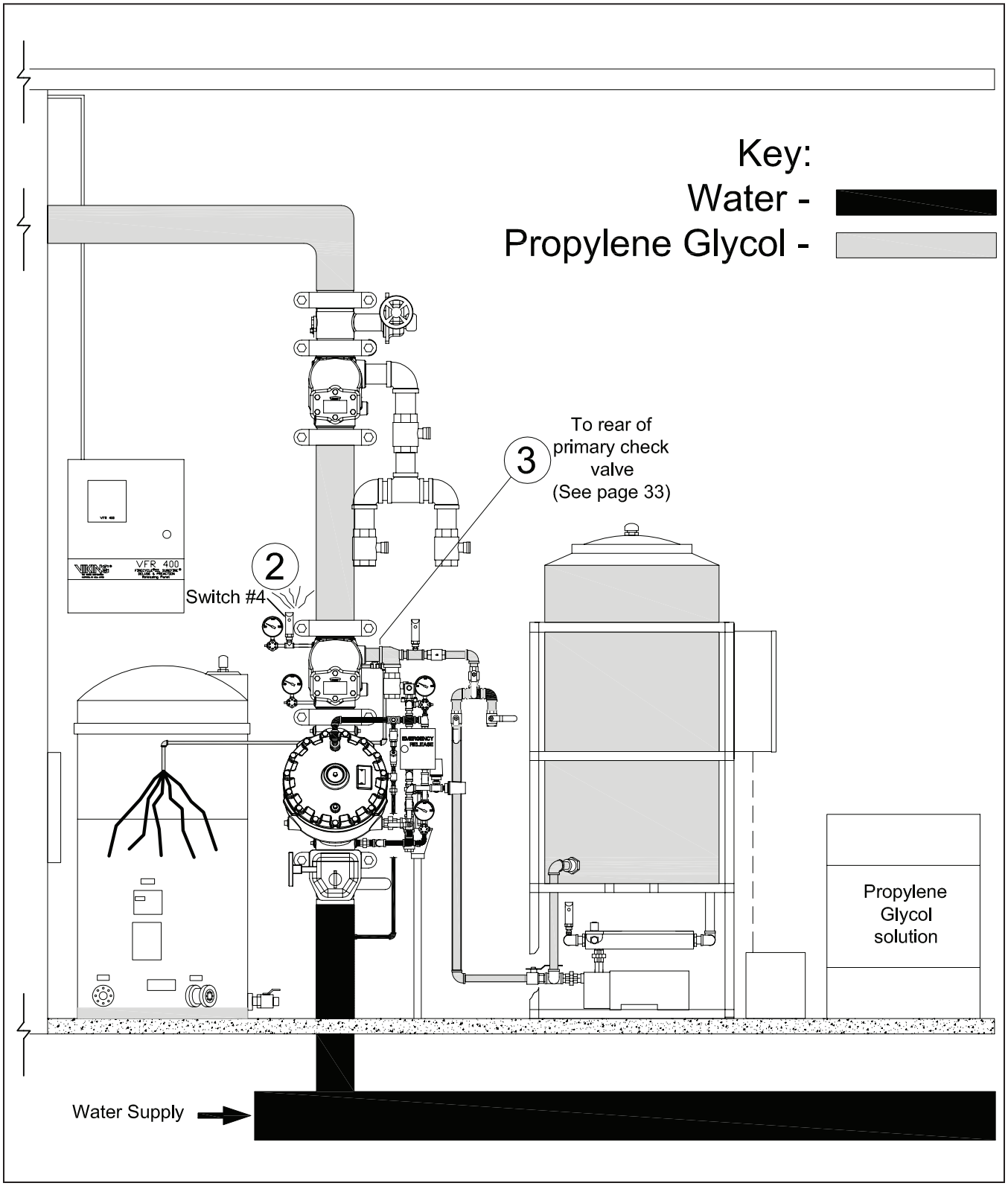
The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



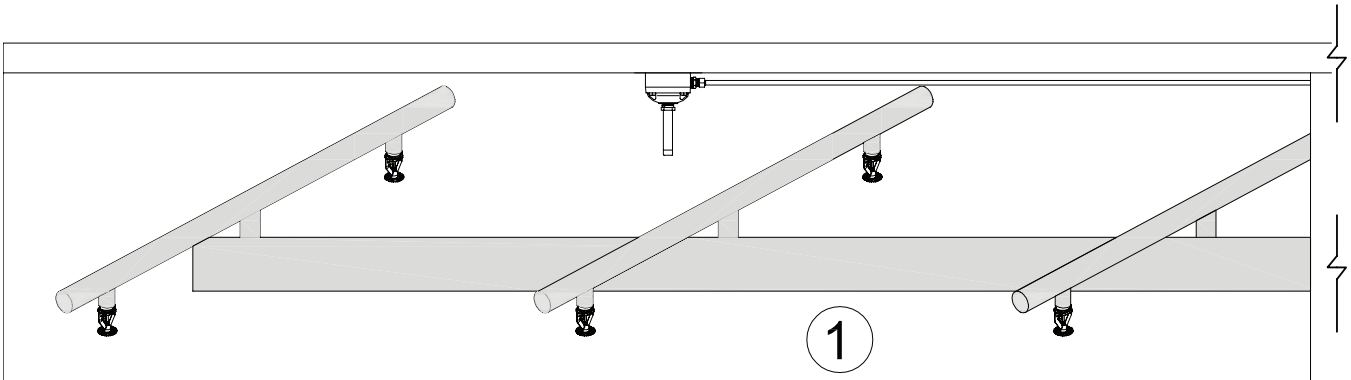
High Pressure Condition:

1. Propylene Glycol solution pressure is increased in the system piping due to increased temperature in the freezer.
2. The digital pressure switch (switch #4) on the automatic pressure control system activates.
3. The 1/4" solenoid valve (Solenoid # 2) on the APCS opens and propylene glycol solution drains into the reclaim tank until the pressure switch re-sets .
4. When the pressure switch re-sets, the 1/4" solenoid valve closes, stopping flow to the reclaim tank.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



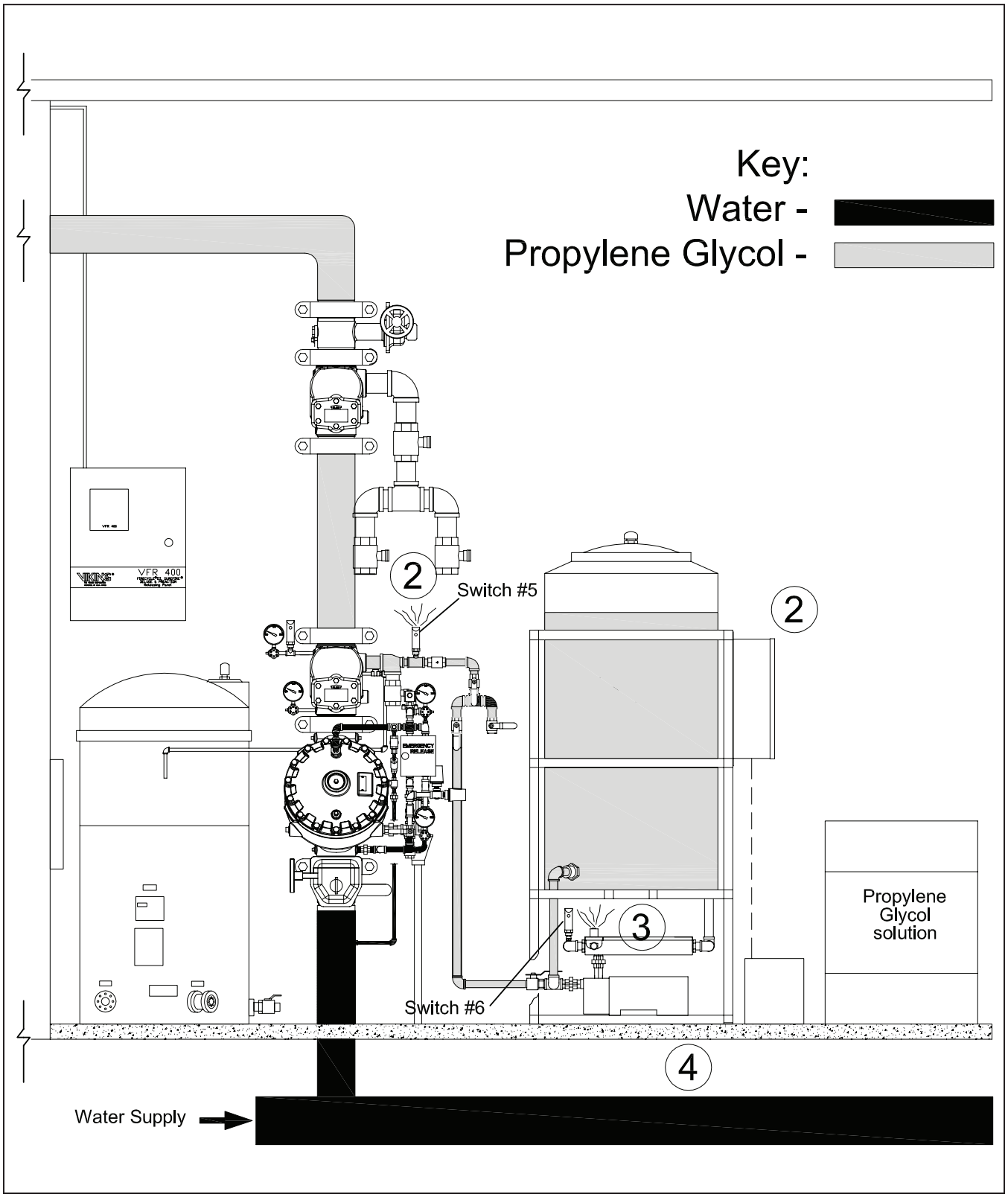
The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



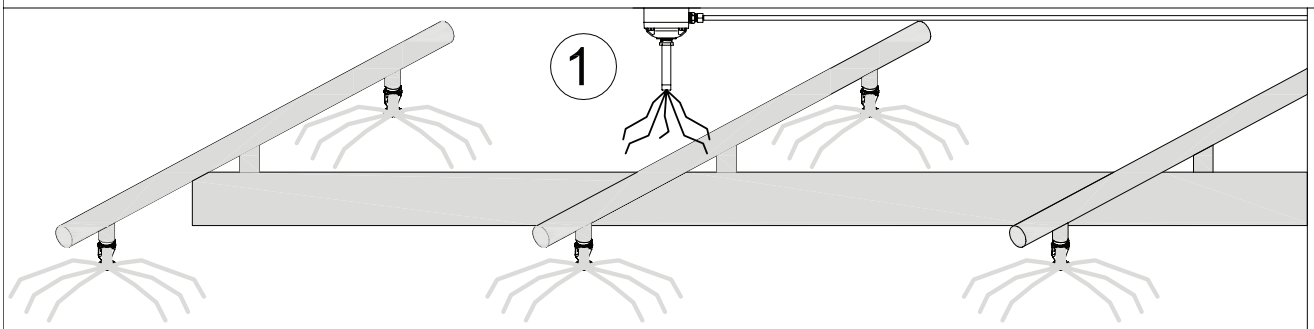
Low Pressure Condition:

1. Propylene glycol solution pressure is decreased in the system piping due to decreased temperature in the freezer.
2. The digital pressure switch (switch #5) senses the pressure drop and activates the CS-1 control panel.
3. The CS-1 control panel powers open the solenoid (solenoid #3), allowing solution to enter the system.
4. The line pressure drops, the digital pressure switch #6 operates and triggers the CS-1 pump. The propylene glycol solution level in the CS-1 tank lowers as it enters the system.
5. When the system pressure is normalized, the digital pressure switch #5 re-sets, and the solenoid valve closes. The pump will operate until the digital pressure switch #6 senses that the line pressure is restored.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



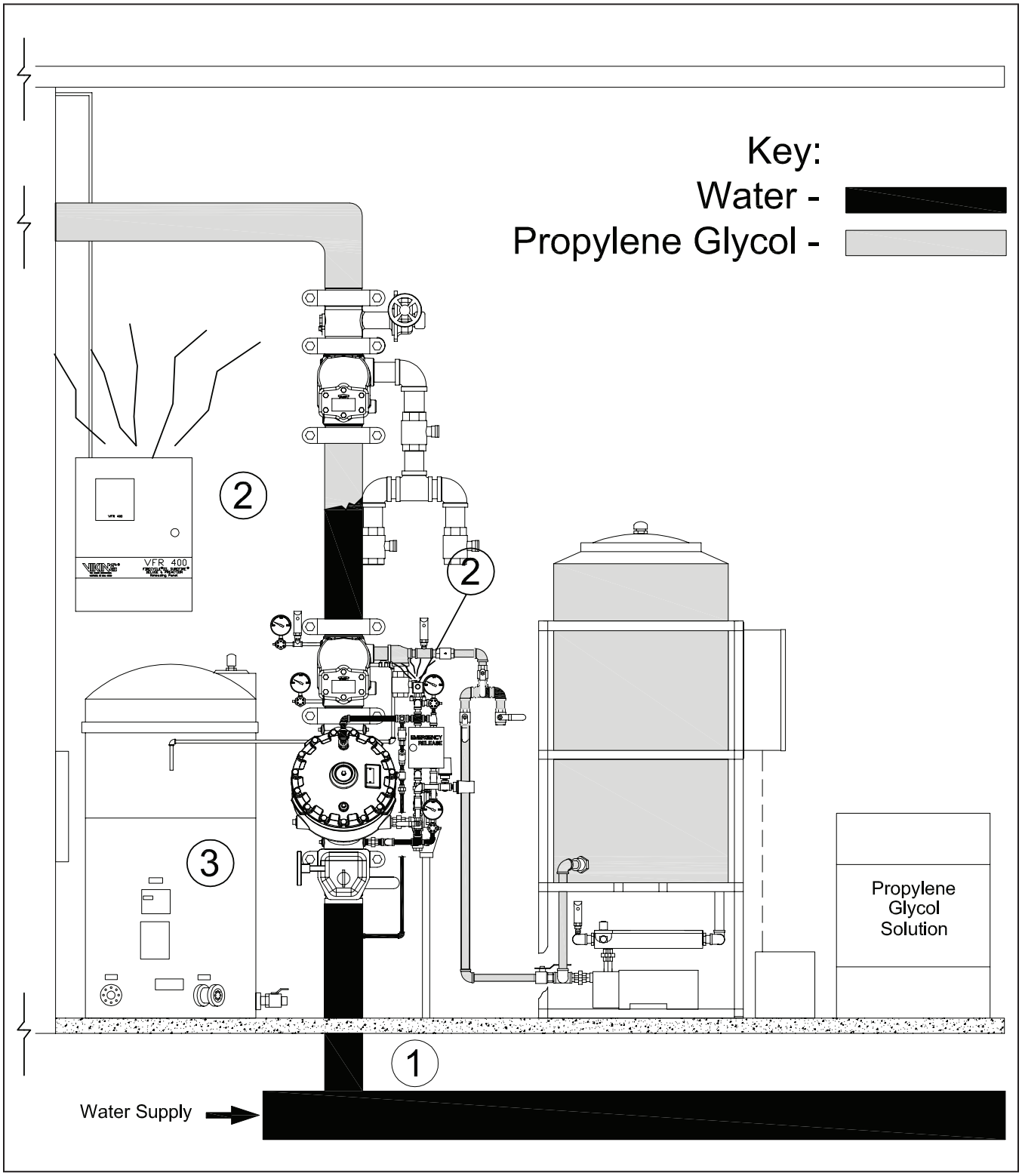
The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



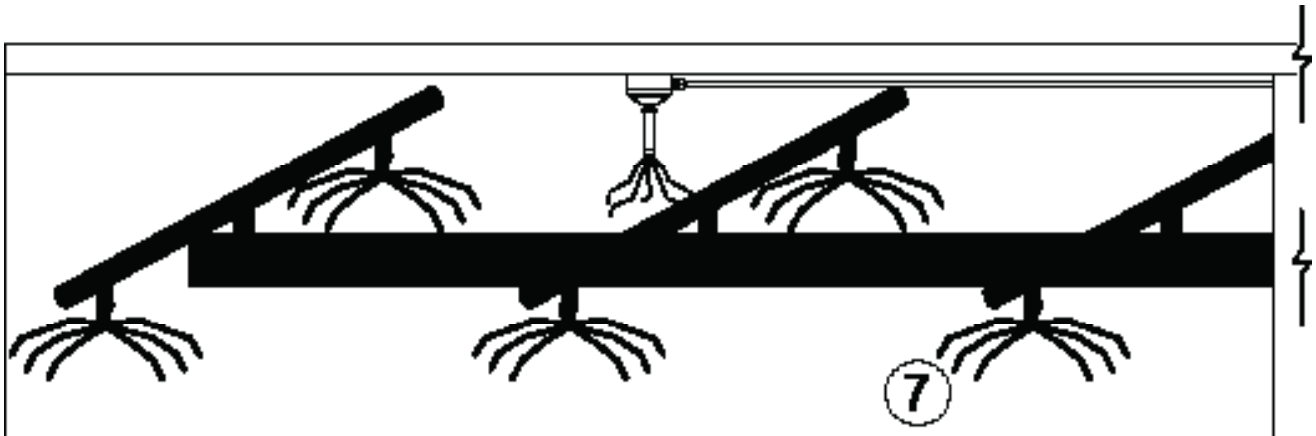
Activation in a fire condition:

1. The heat detector senses elevated temperature caused by a fire.
2. The VFR-400 panel powers the NC solenoid valve (solenoid #1)open, allowing the water in the prime chamber of the deluge valve to drain, opening the deluge valve.
3. Heat from the fire causes the K25.2 ESFR sprinkler(s) to operate.
4. The propylene glycol solution is discharged through the sprinkler. Water displaces the propylene glycol solution in the system piping.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



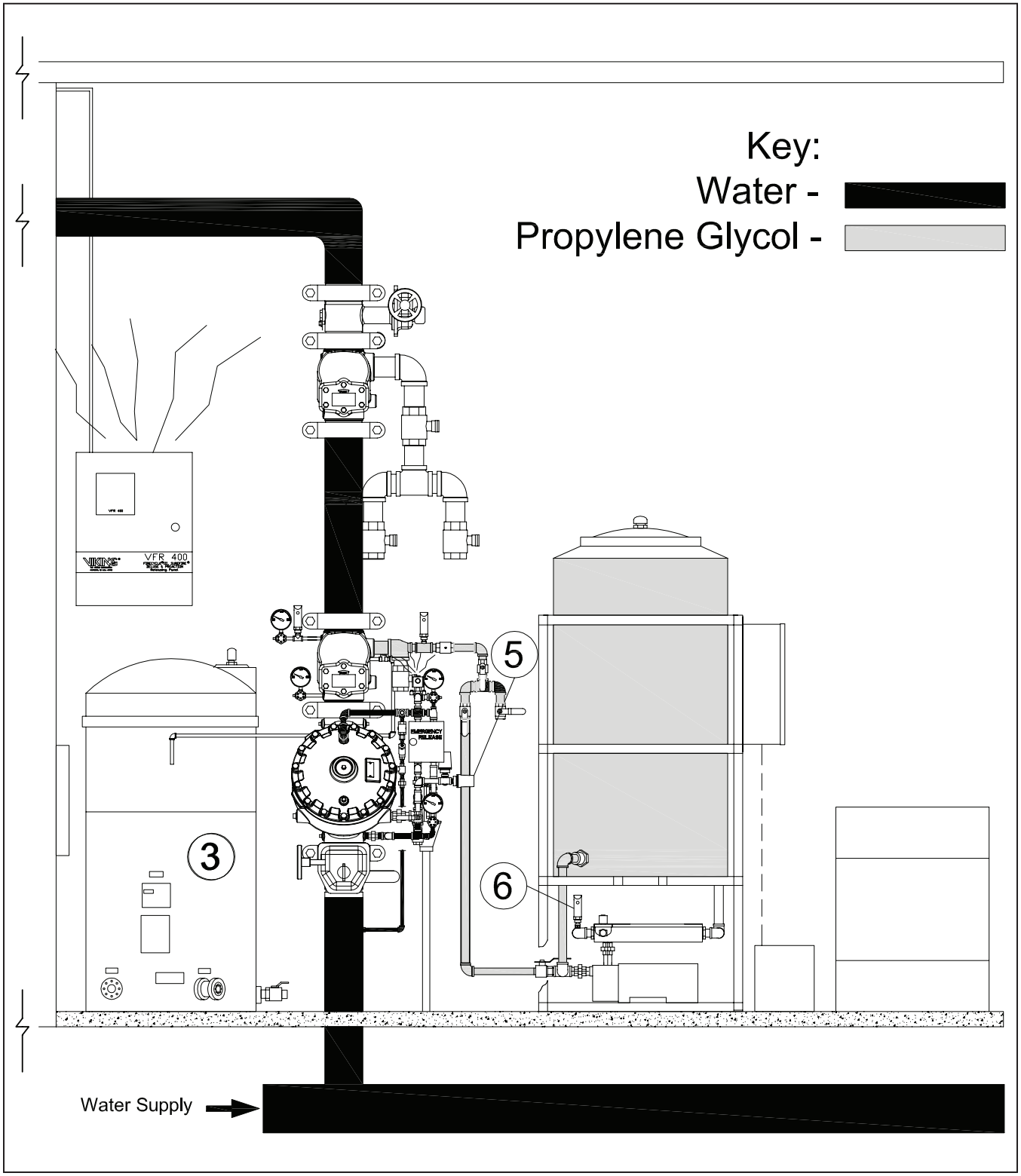
The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



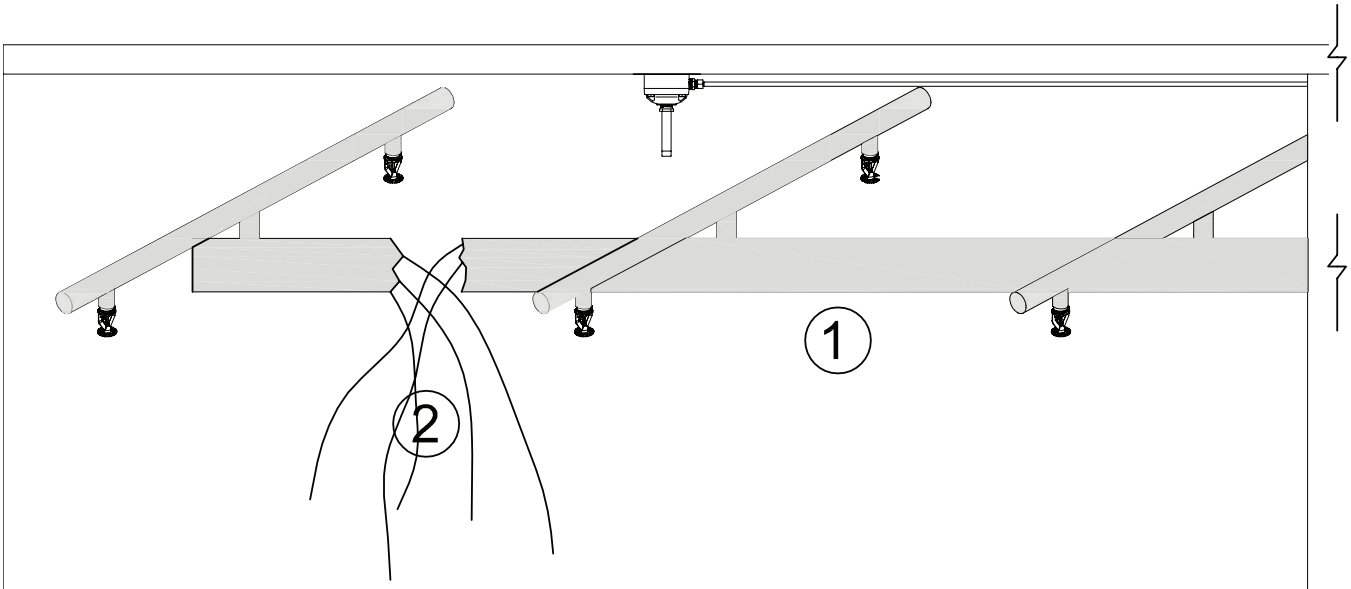
Activation in Fire Condition cont.

5. The water flow pressure switch (switch #2) deactivates the APCS, preventing solution from entering the reclaim tank. Waterflow switch #1 activates which prevents the operation of digital pressure switch #5.
6. The digital pressure switch on the CS-1 tank (switch #6) does not sense any pressure loss. Therefore, the CS-1 pump does not start.
7. Water flows from the open sprinklers until the water supply control valve is closed.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



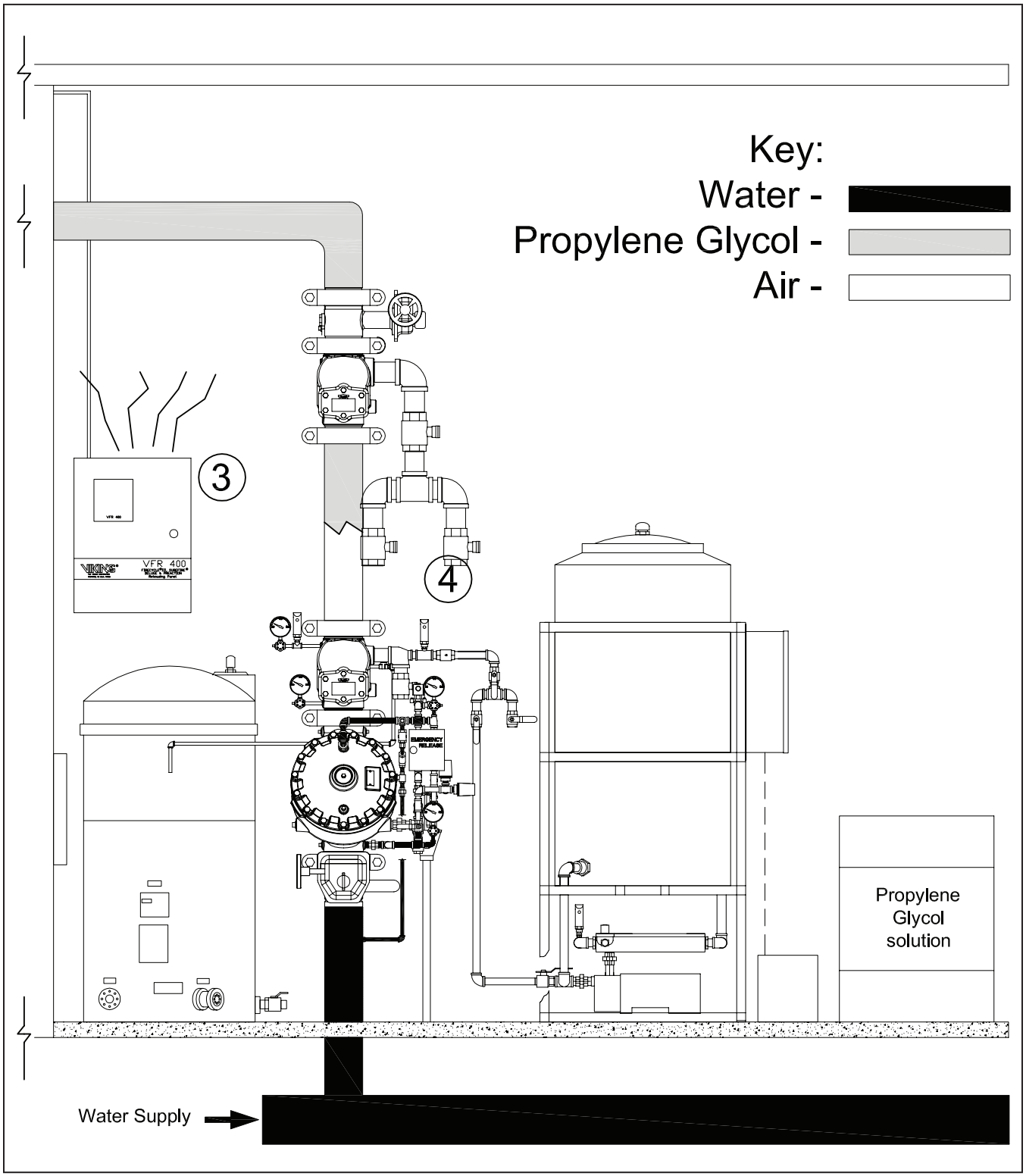
The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



Broken Pipe in Freezer:

1. Pipe breaks or a sprinkler is damaged and activates.
2. Propylene Glycol solution drains out of system piping.
3. The VFR-400 activats a supervisory alarm due to the low system pressure.
4. The low system pressure activates the supply pressure switch (switch #5), which starts the CS-1 pump, and delivers propylene glycol solution to the system.
5. When the CS-1 tank nears empty, the low level alarm activates, and the CS-1 pump shuts off.
6. All of the propylene glycol drains from the system piping and CS-1 tank.
7. The VFR-400 will stay in alarm until the system pressure is restored.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com



The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

VI. SYSTEM INSPECTIONS, TESTS AND MAINTENANCE

1. Solution Test Valves

Multiple propylene glycol/water solution test valves are to be installed on the system piping for semi-annual testing with a refractometer to detect the concentration of antifreeze solution and effectiveness against freezing. When draining sample antifreeze solution from the system, be sure to shut off the system control valve directly upstream of the deluge valve so that water doesn't enter the system. Sampling shall be taken from multiple points within the freezer system. The testing stated in this section is more restrictive than the required test frequency indicated in NFPA 25. Solution test valves should be located in several areas of the system piping as follows:

- The most practical location immediately downstream of the primary Easy Riser® Check Valve.
- The most remote location from the Easy Riser® Check Valve.
- One valve located at the end of 50% of the line piping directly on the AV-1 Air/Vent Valve assembly.
- A test valve shall be located at the end of the nearest line on the tree system and the last line on the tree system.

If the propylene glycol/water solution becomes diluted or does not pass the refractometer test, the entire system is to be drained; all sections of trapped piping are to be drained. Five percent (5%) of the pendent ESFR sprinklers are to be removed and inspected for frozen solution. If any of the pendent ESFR sprinklers are found with frozen solution, then all the pendent ESFR sprinklers are to be removed and replaced with new Viking K25.2 Pendent ESFR VK510 Sprinklers prior to re-charging the system with new 35% or 50% premix propylene glycol/water solution. If the 5% of removed sprinklers are not damaged, they can be re-installed in the system. (Refer to the system service schedule for additional solution tests.)

Ensure that the CS-1 pump antifreeze supply control system is returned to the fully pressurized state once fluid sampling is completed. After the CS-1 pump has restored the antifreeze solution pressure, ensure that the water supply control valve is returned to the fully open position once fluid sampling is completed.

2. Alarm Test Connection

An alarm test connection is provided on the deluge valve trim. When testing the alarm, the downstream isolation valve and antifreeze isolation valve must be shut before opening the test valve. This is a precaution in case the deluge valve would inadvertently operate due to problems in the trim components and cause water to enter the system causing possible contamination of antifreeze. After testing of the alarm, restore the control valves to their normal operating position and open the antifreeze supply valve.

3. Flow Test Valve

Annual flow tests are required for every sprinkler system. When performing annual water flow tests for the ESFR Pre-Primed Single Interlocked Preaction Cold Storage System, you will utilize the main drain of the isolation check valve. This will allow the primary check valve clapper to open also. First, close the supervised system isolation valve downstream of the isolation check valve. Close the antifreeze inlet ball valve.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

The deluge valve must be operated (opened) to perform the flow test. Close the prime line valve and open the emergency manual release valve. Make sure the diversion drain valve is open to flow water to a drain area or the recovery tank as desired. Note: If antifreeze is stored in the recovery tank, do not allow water to enter, or contamination of solution will occur. Record the water supply pressure on the water supply pressure gauge upstream of the deluge valve.

Open the main drain on the downstream Isolation check valve fully. This will allow water to flow through the deluge valve and both the primary and isolation check valves. Once the pressure gauge has settled to flowing pressure, record the pressure on the water supply pressure gauge upstream of the deluge valve.

After the water flow test is completed, close the water supply control valve upstream of the deluge valve, drain all the water located between the primary and isolation check valves. Then drain all water from between the deluge valve and the primary check valve using the auxiliary drain on the deluge valve trim. Close the main drain and auxiliary drain once water is completely drained. Open the antifreeze supply isolation valve. The CS-1 pump will supply propylene glycol/water solution from the maintenance solution supply tank. The CS-1 pump will stop running when the pressure in the section of piping is 50 PSI (3.45 Bar) or the set pressure of the system pressure switch. Ensure there is no trapped air in the piping between check valves by bleeding through the main drain valve of the isolation check valve. After system pressure is built, the CS-1 pump will stop running. Open the down stream system isolation valve, when system antifreeze pressure is at desired pressure and the CS-1 pump stops. Now, prime the deluge valve by opening the prime supply valve and watch for pressure to build in the prime chamber of the deluge valve. Now, open the system shut-off valve up stream of the deluge valve. Any supervisory alarm switches silenced for system maintenance must be re-set. The system is now in service.

4. SERVICE PROCEDURES

A. Drain-Down of the Individual System (if system operation has occurred):

1. After system trip and sprinkler(s) have operated and water has entered the system, the complete system must be drained down immediately and solution within the piping system disposed of.
2. All sprinklers are pendent type and must be removed and replaced with new sprinklers. This is due to possible collection of water at each sprinkler and creation of a small ice plug in each sprinkler.
3. If using the Viking Model AV-1 Air/vent Valve assembly the device also breaks a vacuum in the piping system and provides faster and more complete drainage of the system piping.

B. Taking the System Out of Service:

1. Close the water supply control valve to the riser being serviced.
2. Close the antifreeze supply valve to the riser being serviced.
3. If the system is being serviced, then the solution in the system can be drained into clean containers or reclaim tank and reused as long as water has not entered the systems. Solution should be checked at various points while draining for proper refractometer readings to verify freeze-protection properties.
4. Open vent/bleed valves at high points of the system or if the AV-1 Vent Valve is applied it will automatically open.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

5. Open the main drain and collect solution in clean containers or recovery tank for re-use in system.
6. After the system is completely drained from the main drain, open any low-point drains to remove the remaining solution from the system.

C. Placing the System in Service (after it has been completely drained):

1. Close the main drain valve on the riser.
2. Connect the propylene glycol/water solution fill pump (NOT the CS-1 pump) to the connection located on the main drain assembly.
3. Close the main drain valve, vent/bleed valves, and low-point drains if opened. Ensure there are no openings on system piping.
4. Fill system with Firefighter Eliminator C or Eliminator F propylene glycol/water solution. While filling, periodically open the manual vent/bleed valves or allow the Model AV-1 Vent Valve to automatically open on system piping to ensure air is eliminated from system piping. Slow fill is recommended to minimize the entrainment of air.
5. Fill and pressurize system piping to 50 PSI (3.45 Bar) minimum using the CS-1 Pump system to provide the final set system pressure.
6. Check for trapped air by cracking open vent/bleed valves or observe the AV-1 Vent Valve. Ensure all trapped air is eliminated from the system.
7. After system pressure is attained, the water supply control valve up stream of the deluge valve can be opened.

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

APPENDIX A - ORDERING A COMPLETE SYSTEM

To install a complete ESFR Pre-Primed Single Interlock Preaction Cold Storage System, the following components must be ordered:

Item	Enter Part Number Unless Already Provided	Qty. Per Riser	Total (Quantity X Number of Risers unless otherwise noted)
Water Supply Control Valve (See Table A)		1	
Deluge Valve (See Table B)		1	
Conventional Deluge Valve Trim (See Table C)		1	
Electric Release Trim (See Table D)		1	
Electric Release Solenoid Valve	11601	1	
Easy Riser Check Valves (See Table E)		2	
Cold Storage Trim with APCS	14032	1	
Bypass Trim (See Table F)		1	
Digital Supervisory Pressure Switch	13057	1	
Pressure Switch Cable	13231	1	
Single Switch PS-10 Water Flow Pressure Switch	PS-101A	1	
Double Switch PS-10 Water Flow Pressure Switch	PS-102A	1	
System Isolation Valve (See Table G)		1	
CS-1 Tank and Pump Package (See Table H)		1	1
VFR-400 Release Control Panel	14152	1	1
Reclaim tank for Automatic Pressure Control System (See Table I)		1	
System Reclaim Tank (See Table I)		1	1
AV-1 Automatic Air Vent (One for each high point)	13495		
Propylene Glycol Solution (See Table J)			
K25.2 ESFR Pendent Sprinklers	12080AC		

VIKING®

TECHNICAL DATA

ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

Table A - Water Supply Control Valve

VALVE SIZE	PART NUMBER
4” (DN100)	8068A-0400
6” (DN150)	8068A-0600
8” (DN200)	8068A-0800

Table B - Deluge Valve Part Numbers

DESCRIPTION	NOMINAL SIZE	PART NUMBER	TECHNICAL DATA PAGE
Straight Through			
Flange Drilling	**Model F-1 Flange/Flange**		
ANSI	4"	11953	218a-j
ANSI	6"	11955	
ANSI	8"	11991	
PN10/16	DN100	11965	
PN10/16	DN150	11956	
PN10	DN200	11995	
PN16	DN200	11999	
Flange Drilling / Pipe O.D.	**Model F-1 Flange/Groove**		
ANSI / 114mm	4"	11952	218a-j
ANSI / 168mm	6"	11954	
PN10/16 / 114mm	DN100	11958	
PN10/16 / 165mm	DN150	12640	
PN10/16 / 168mm	DN150	11954	
Pipe O.D.	**Model F-1 Groove/Groove**		
114mm	4" / DN100	11513	218a-j
165mm	DN150	11910	
168mm	6" / DN150	11524	
219mm	8" / DN200	11018	

Table C - Deluge Valve Conventional Trim Part Numbers

DESCRIPTION	NOMINAL SIZE	PART NUMBER	TECHNICAL DATA PAGE
Use with Straight Through Valves			
Horizontal	4" / DN100	14638-1	240a-c
	6" / DN150	14640-1	241a-c
	8" / DN200	14643-1	242a-c
Vertical	4" / DN100	14639-1	240e-g
	6" / DN150	14641-1	241e-g
	8" / DN200	14642-1	242e-g

Table D - Electric Release Trim Part Numbers

DESCRIPTION	PART NUMBER	TECHNICAL DATA PAGE
Straight Through Style Release Trim	10830	265a

Table E - Easy Riser® Check Valve Part Numbers

DESCRIPTION	NOMINAL SIZE	PART NUMBER	TECHNICAL DATA PAGE
Easy Riser® Check Valve			
Flange Drilling	**Flange/Flange**		815a-g
ANSI	4"	08508	
ANSI	6"	08511	
PN10/16	DN100	08797	
PN10/16	DN150	08835	
PN10	DN200	08836	
PN16	DN200	12355	
Flange Drilling / Pipe O.D.	**Flange/Groove**		
ANSI / 114mm	4"	08509	
ANSI / 168mm	6"	08512	
ANSI / 219mm	8"	08515	
PN10/16 / 114mm	DN100	12649	
PN10/16 / 165mm	DN150	12652	
PN10 / 219mm	DN200	12651	
PN16 / 219mm	DN200	12650	
Pipe O.D.	**Groove/Groove**		
114mm	4" / DN100	08510	
165mm	DN150	12356	
168mm	6" / DN150	08513	
219mm	8" / DN200	08516	

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

Table F - Easy Riser® Check Valve Bypass Trim

NOMINAL SIZE	PART NUMBER	TECHNICAL DATA PAGE
4" / DN100	14038	48a-d
6" / DN150	14039	
8" / DN200	14040	

Table G - System Isolation Valve

VALVE SIZE	PART NUMBER
4” (DN100)	01G-0400
6” (DN150)	01G-0600
8” (DN200)	01G-0800

Table H - CS-1 Tank and Pump Package Part Numbers

NUMBER OF RISERS	TANK SIZE	PART NUMBER		TECHNICAL DATA PAGE
		US (60 Hz.)	International (50 Hz.)	
1	65 gal	13050-1	13051-1	51a-h
2	65 gal	13050-2	13051-2	
3	160 gal	13050-3	13051-3	
4	160 gal	13050-4	13051-4	
5	160 gal	13050-5	13051-5	
6	160 gal	13050-6	13051-6	

Table I - Reclaim Tanks

GALLONS	PART NUMBER	TECHNICAL DATA PAGE
55	F02250	Foam 251a-d
65	F02251	
100	F02252	
150	F02253	
200	F02254	
300	F02255	
450	F02256	
550	F02257	
800	F02258	
900	F02259	
1150	F02260	
1400	F02261	
1700	F02262	
1900	F02263	
2250	F02264	
2400	F02265	
2600	F02266	
2750	F02267	
3800	F02268	
4000	F02269	
4900	F02270	
5200	F02271	
5350	F02272	
5900	F02273	
6250	F02274	
8100	F02275	
10100	F02276	
11900	F02277	

Table J - Propylene Glycol Solution

	PART NUMBER	TECHNICAL DATA PAGE
Firefighter C 35% Solution		
55 Gallon Drum	12968-55	50a-b
275 Gallon Drum	12968-275	
Tanker Delivery	12968-Bulk	
Firefighter F 50% Solution		
55 Gallon Drum	12967-55	49a-b
275 Gallon Drum	12967-275	
Tanker Delivery	12967-Bulk	

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

APPENDIX B - ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM PIPING ESTIMATING TOOL

Appendix B provides information on how to set up a Microsoft Excel spreadsheet to compare the friction loss values when using the Hazen Williams formula and the Darcy-Weisbach formula. This tool can be helpful in the project estimating phase for large systems that use propylene glycol solution.

This spreadsheet is not intended to be used for hydraulic calculations. It should be used as a reference only.

	A	B	C	D	E	F	G	H
1		Hazen Willams	Darcey Wiesbach	Reynolds Number	**E1**			Turbulent
2	PSI Loss Per Foot	**B2**	**C2**	Calculated Friction Factor	**E2**			Laminar
3	Total PSI Loss	**B3**	**C3**					
4								
5		Inputs						
6		Hazen Willams	Darcey Wiesbach					
7	Flow Rate (GPM)							
8	C of Pipe		None	Typical values are 120				
9	internal pipe dia (in.)							
10	Length of pipe (ft)							
11	friction factor	None		See cell above or may also be found in table				
12	density (lbs/ft^3)	None		Temperature (F)	60	0	-10	-20
13				Density	64.96	65.89	66.2	67.7
14	viscosity (centipose)	None		Viscosity	8.13	61	96	180
15	Relative Pipe Roughness	None		Typical values are .00033				

Step 1: Create the table as shown. Enter the formulas and constant values highlighted in gray. Formulas are listed to the right.

Enter the following formulas in the cells listed:
E1 =47.6*C7*C12/(C9*C14)
B2 =4.52*B7^1.85/(B8^1.85*B9^4.87)
C2 =IF(E1>2000,G1,G2)
E2 =(1/(-1.8*LOG10(6.9/E1+(C15*12/(C9*3.7))^1.11)))^2
B3 =B2*B10
C3 =C2*C10

	A	B	C	D	E	F	G	H
1		Hazen Willams	Darcey Wiesbach	Reynolds Number	#DIV/0!		#DIV/0!	Turbulent
2	PSI Loss Per Foot	#DIV/0!	#DIV/0!	Calculated Friction Factor	#DIV/0!		#DIV/0!	Laminar
3	Total PSI Loss	#DIV/0!	#DIV/0!					
4								
5		Inputs						
6		Hazen Willams	Darcey Wiesbach					
7	Flow Rate (GPM)	803.8	803.8					
8	C of Pipe		None	Typical values are 120				
9	internal pipe dia (in.)							
10	Length of pipe (ft)							
11	friction factor	None		See cell above or may also be found in table				
12	density (lbs/ft^3)	None		Temperature (F)	60	0	-10	-20
13				Density	64.96	65.89	66.2	67.7
14	viscosity (centipose)	None		Viscosity	8.13	61	96	180
15	Relative Pipe Roughness	None		Typical values are .00033				

Step 2: Input Flow Rate into cells B7 and C7

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

	A	B	C	D	E	F	G	H
1		Hazen Willams	Darcey Wiesbach	Reynolds Number	#DIV/0!		#DIV/0!	Turbulent
2	PSI Loss Per Foot	#DIV/0!	#DIV/0!	Calculated Friction Factor	#DIV/0!		#DIV/0!	Laminar
3	Total PSI Loss	#DIV/0!	#DIV/0!					
4								
5		Inputs						
6		Hazen Willams	Darcey Wiesbach					
7	Flow Rate (GPM)	803.8	803.8					
8	C of Pipe	120	None	Typical values are 120				
9	internal pipe dia (in.)							
10	Length of pipe (ft)							
11	friction factor	None		See cell above or may also be found in table				
12	density (lbs/ft^3)	None		Temperature (F)	60	0	-10	-20
13				Density	64.96	65.89	66.2	67.7
14	viscosity (centipose)	None		Viscosity	8.13	61	96	180
15	Relative Pipe Roughness	None		Typical values are .00033				

Step 3: input Hazen Willimas C factor in cell B8

	A	B	C	D	E	F	G	H
1		Hazen Willams	Darcey Wiesbach	Reynolds Number	#DIV/0!		#DIV/0!	Turbulent
2	PSI Loss Per Foot	0.482844424	#DIV/0!	Calculated Friction Factor	#DIV/0!		0	Laminar
3	Total PSI Loss	0	#DIV/0!					
4								
5		Inputs						
6		Hazen Willams	Darcey Wiesbach					
7	Flow Rate (GPM)	803.8	803.8					
8	C of Pipe	120	None	Typical values are 120				
9	internal pipe dia (in.)	3.26	3.26					
10	Length of pipe (ft)							
11	friction factor	None		See cell above or may also be found in table				
12	density (lbs/ft^3)	None		Temperature (F)	60	0	-10	-20
13				Density	64.96	65.89	66.2	67.7
14	viscosity (centipose)	None		Viscosity	8.13	61	96	180
15	Relative Pipe Roughness	None		Typical values are .00033				

Step 4: input internal pipe diameter into cells C8 and D8

	A	B	C	D	E	F	G	H
1		Hazen Willams	Darcey Wiesbach	Reynolds Number	#DIV/0!		#DIV/0!	Turbulent
2	PSI Loss Per Foot	0.482844424	#DIV/0!	Calculated Friction Factor	#DIV/0!		0	Laminar
3	Total PSI Loss	4.828444243	#DIV/0!					
4								
5		Inputs						
6		Hazen Willams	Darcey Wiesbach					
7	Flow Rate (GPM)	803.8	803.8					
8	C of Pipe	120	None	Typical values are 120				
9	internal pipe dia (in.)	3.26	3.26					
10	Length of pipe (ft)	10	10					
11	friction factor	None		See cell above or may also be found in table				
12	density (lbs/ft^3)	None		Temperature (F)	60	0	-10	-20
13				Density	64.96	65.89	66.2	67.7
14	viscosity (centipose)	None		Viscosity	8.13	61	96	180
15	Relative Pipe Roughness	None		Typical values are .00033				

Step 5: input pipe length into cells C9 and D9

VIKING®

TECHNICAL DATA

ESFR PRE-PRIMED SINGLE INTERLOCK PREACTION COLD STORAGE SYSTEM

The Viking Corporation, 210 N Industrial Park Road, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

	A	B	C	D	E	F	G	H
		Hazen Willams	Darcey Wiesbach	Reynolds Number	#DIV/0!		#DIV/0!	Turbulent
1	PSI Loss Per Foot	0.482844424	#DIV/0!	Calculated Friction Factor	#DIV/0!		0	Laminar
2	Total PSI Loss	4.828444243	#DIV/0!					
3								
4		Inputs						
5		Hazen Willams	Darcey Wiesbach					
6	Flow Rate (GPM)	803.8	803.8					
7	C of Pipe	120	None	Typical values are 120				
8	internal pipe dia (in.)	3.26	3.26					
9	Length of pipe (ft)	10	10					
10	friction factor	None		See cell above or may also be found in table				
11	density (lbs/ft^3)	None	67.7	Temperature (F)	60	0	-10	-20
12				Density	64.96	65.89	66.2	67.7
13	viscosity (centipose)	None		Viscosity	8.13	61	96	180
14	Relative Pipe Roughness	None		Typical values are .00033				
15								

Step 6: select propylene glycol density for the lowest operating temperature from cells E11 to H13, and input into cell C11.

	A	B	C	D	E	F	G	H
		Hazen Willams	Darcey Wiesbach	Reynolds Number	4414.215365		1.00584	Turbulent
1	PSI Loss Per Foot	0.482844424	1.005839552	Calculated Friction Factor	0.039199298		0.361243	Laminar
2	Total PSI Loss	4.828444243	10.05839552					
3								
4		Inputs						
5		Hazen Willams	Darcey Wiesbach					
6	Flow Rate (GPM)	803.8	803.8					
7	C of Pipe	120	None	Typical values are 120				
8	internal pipe dia (in.)	3.26	3.26					
9	Length of pipe (ft)	10	10					
10	friction factor	None		See cell above or may also be found in table				
11	density (lbs/ft^3)	None	67.7	Temperature (F)	60	0	-10	-20
12				Density	64.96	65.89	66.2	67.7
13	viscosity (centipose)	None	180	Viscosity	8.13	61	96	180
14	Relative Pipe Roughness	None		Typical values are .00033				
15								

Step 7: select propylene glycol Viscosity for the lowest operating temperature from cells E13 to H13, and input into cell C13.

	A	B	C	D	E	F	G	H
		Hazen Willams	Darcey Wiesbach	Reynolds Number	1071.97666		0.098074	Turbulent
1	PSI Loss Per Foot	0.035210409	0.087726545	Calculated Friction Factor	0.064809672		0.087727	Laminar
2	Total PSI Loss	0.352104092	0.877265452					
3								
4		Inputs						
5		Hazen Willams	Darcey Wiesbach					
6	Flow Rate (GPM)	195.2	195.2					
7	C of Pipe	120	None	Typical values are 120				
8	internal pipe dia (in.)	3.26	3.26					
9	Length of pipe (ft)	10	10					
10	friction factor	None		See cell above or may also be found in table				
11	density (lbs/ft^3)	None	67.7	Temperature (F)	60	0	-10	-20
12				Density	64.96	65.89	66.2	67.7
13	viscosity (centipose)	None	180	Viscosity	8.13	61	96	180
14	Relative Pipe Roughness	None	0.00033	Typical values are .00033				
15								

Step 8: Enter Relative Pipe Roughness. Compare the 2 friction loss values in cells B2 and C2.